FORWARD TOGETHER RELIABILITYFIRST

2024 FALL RELIABILITY SUMMIT

Brian Thiry, Director, Entity Engagement and External Affairs

Michelle Cross, Manager, External Affairs

Sept. 17, 2024

RELIABILITY FIRST

FORWARD TOGETHER RELIABILITYFIRST

FERC TRANSMISSION REFORM

ERIC VANDENBERG

Deputy Director of the Office of Reliability, FERC

Office of Electric Reliability

Eric Vandenberg, Acting Director, Office of Electric Reliability

September 17, 2024

The views expressed in this presentation are my own and do not represent those of the Commission or any individual Commissioner.

Agenda

- Overview of OER
- Recent Reliability Orders
- Order 1920
- Upcoming Technical Conferences
- Questions

OER Performs 5 Key Functions

- Advise on whether to approve, remand or require changes to reliability standards proposed by NERC
- Oversee compliance with approved standards by users, owners, and operators of the Bulk-Power System (BPS); review NERC-proposed penalties
- Provide engineering support on rate filings, focusing on potential reliability impacts
- Monitor the status of the BPS to keep the Commission informed of evolving events
- Review blackouts and major events for possible violations of, or gaps in, reliability standards

- More info available in Electric Reliability Primer

Priorities

Cyber and Physical Security

- Supply Chain Compromise
- Protections for Low Impact Assets
- Physical Security

Resource Transition

- Inverter Based Resources
- Resource/Energy Adequacy
- Priority System Attributes (e.g., quick start, ramping)

Extreme Weather

- Asset Hardening (e.g., generator freeze protection)
- System Planning and Design

Recent Reliability Orders

- IBR Registration
  - Approved NERC's proposal
  - Category 2 GO/ GOP Compliant by May 2026
- EOP-012-2 (Generator Winterization)
  - Approved, effective October 1
  - Directed further modifications due March 2025
- DLR ANOPR
  - Comments are due October 15, 2024, and reply comments are due November 12, 2024

Order No. 1920

- Conduct long-term transmission planning to account for expected changes in generation and demand
- Consider a required set of minimum benefits when planning new facilities
- Identify opportunities to “right-size” transmission facilities to increase their transfer capability
- Expands states’ pivotal role throughout the process

Recent/ Upcoming Conferences

- Innovations and Efficiencies in Generator Interconnection Workshop
  - Discussion of opportunities for further innovation and increased efficiency in the generator interconnection process
  - September 10-11, 2024
- Annual Reliability Tech Conference
  - Discuss policy issues related to the reliability and security of the Bulk-Power System
  - October 16, 2024
- Co-Location of Large Loads at Generating Facilities
  - Discuss generic issues related to the co-location of large loads at generating facilities
  - November 1, 2024

Questions?

NERC INTERREGIONAL TRANSFER CAPABILITY STUDY UPDATE

JOHN MOURA

Director of Reliability Assessment and Performance Analysis, NERC

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

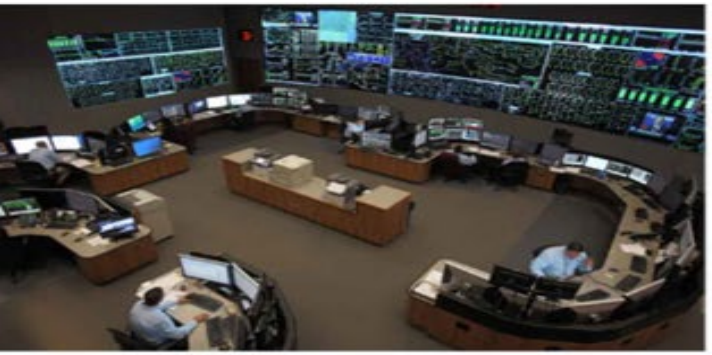
NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Assuring a Reliable BPS through the Expansion of Interregional Transfer Capability: NERC ITCS

John Moura
Director, Reliability Assessment and Performance Analysis

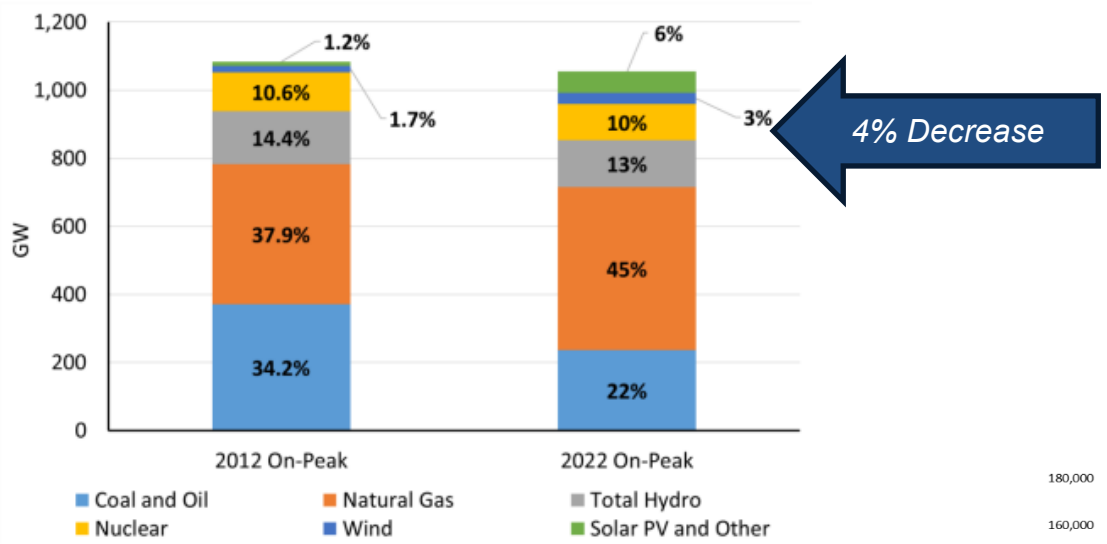
2024 Fall Reliability and Security Summit
September 17, 2024

RELIABILITY | RESILIENCE | SECURITY



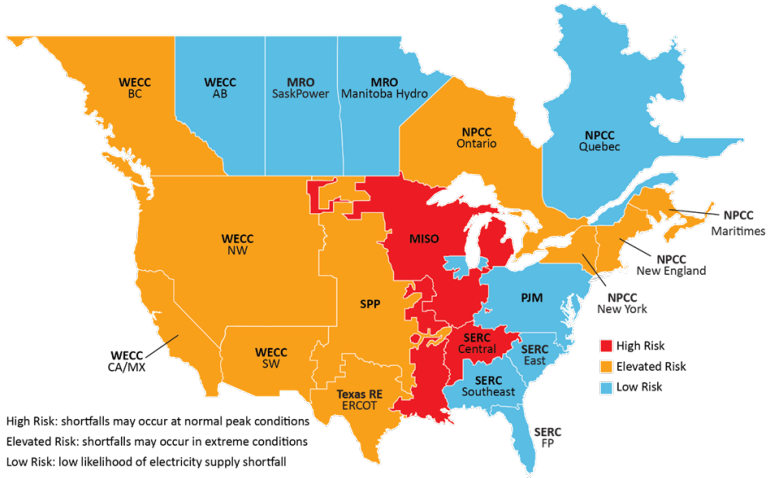

Across an Interconnected System:
Less Resources Means More Reliance on Neighbors

2012 and 2022 Peak Capacity Resource Mix NERC-Wide

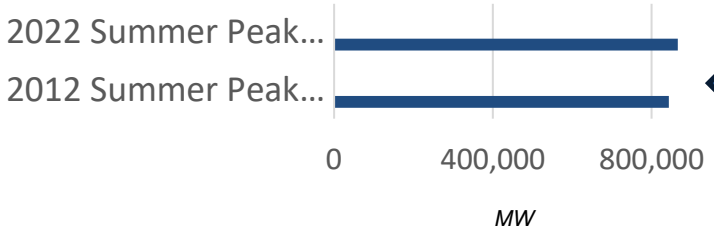


4% Decrease

2024-2033 Risk Areas

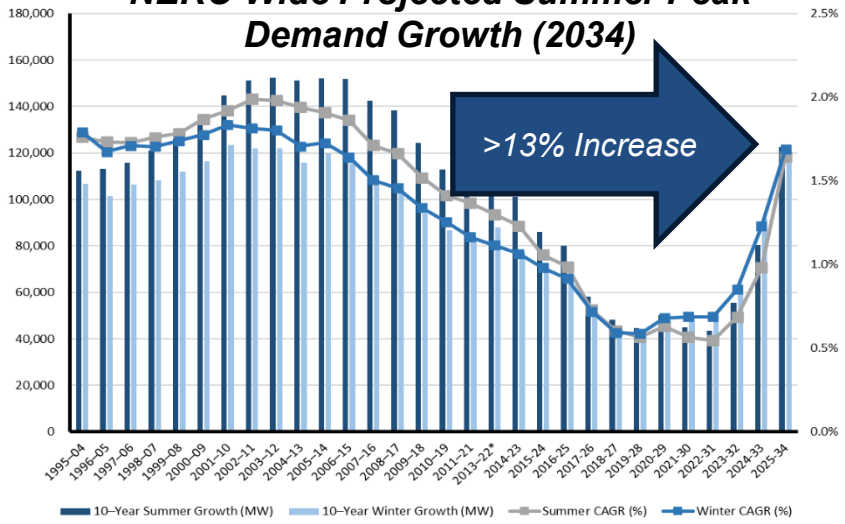


NERC-Wide Summer Peak Demand Changes 2012 and 2022



3% Increase

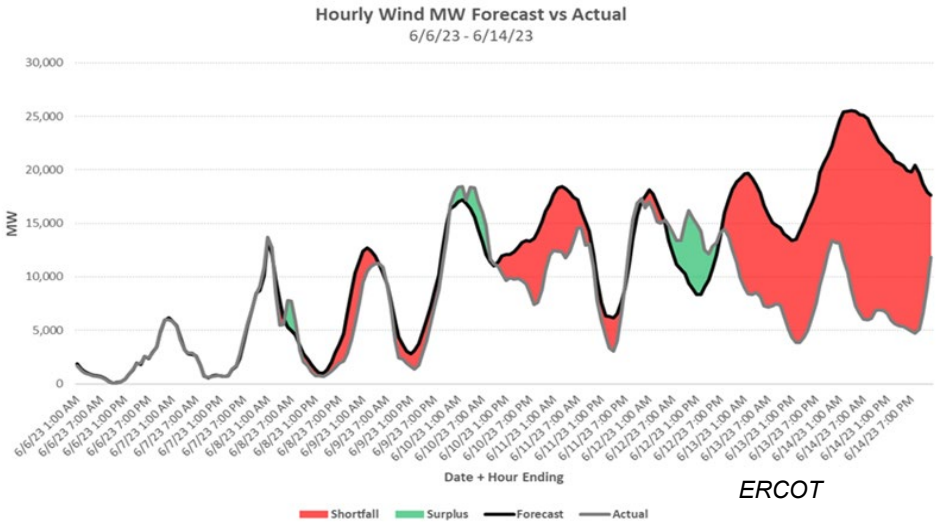
NERC-Wide Projected Summer Peak Demand Growth (2034)



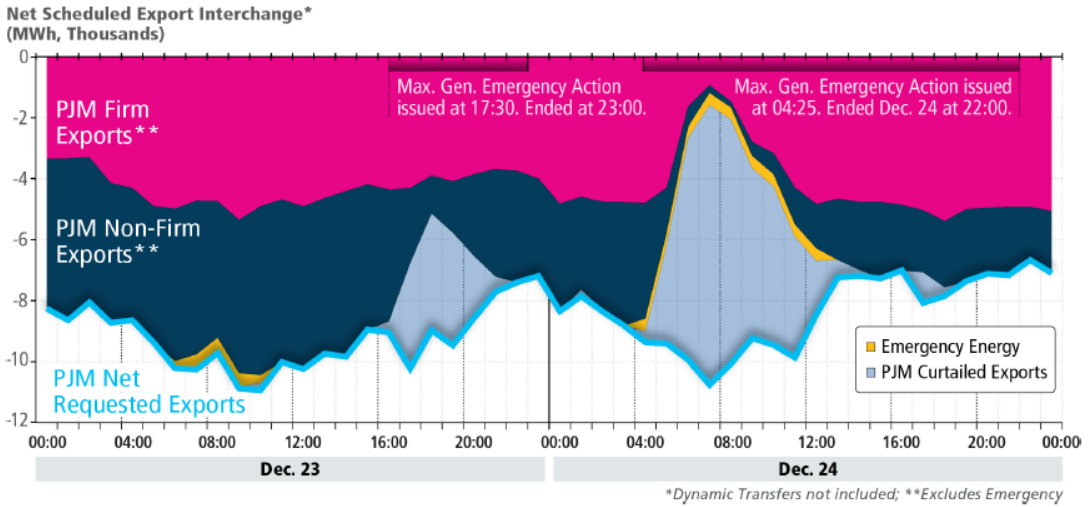
>13% Increase

Recent Examples Highlight Need for Wide-Area Energy Assessments

June 6, 2023: ERCOT, SPP, MISO: *A "wind drought" caused 60 GW of installed wind capacity to generate 300 MW*



ERCOT



December 24, 2022: PJM: *Transmission system during extreme cold weather limited the ability to export to support southern neighbors*

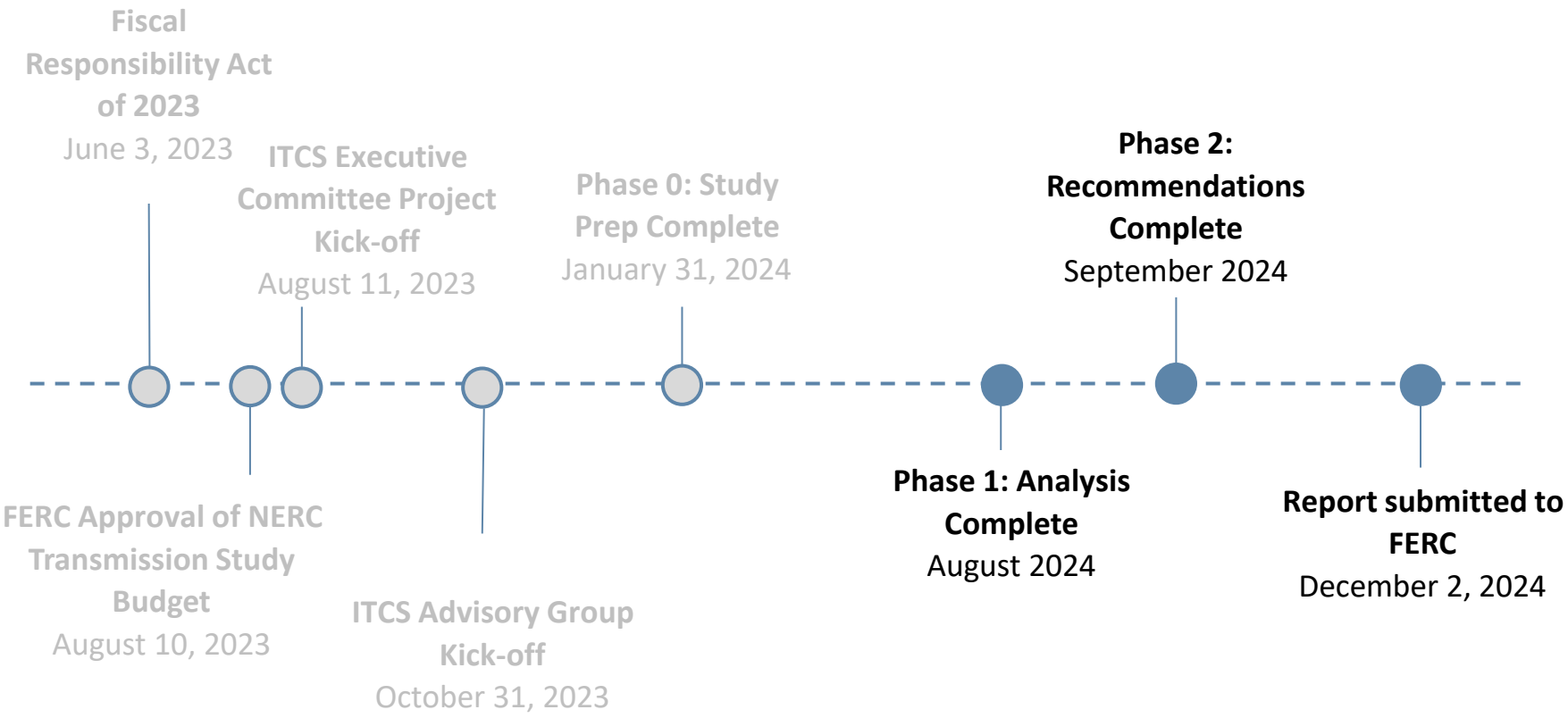
FRA of 2023: Required Study Elements

Fiscal Responsibility Act (FRA), Section 322

In consultation with the Regional Entities and transmitting utilities, NERC shall conduct a study containing three elements:

1. **Current total transfer capability,** between each pair of neighboring transmission planning regions.
2. A recommendation of **prudent additions to total transfer capability** between each pair of neighboring transmission planning regions that would demonstrably strengthen reliability within and among such neighboring transmission planning regions.
3. Recommendations on **how to meet and maintain the identified total transfer capability**, together with the prudent recommended additions in #2.

ITCS Timeline Overview



Transfer Capability Observations and Findings

Varies Widely

- Current transfer capability changes (TTC) as percentage of peak load = 1% to 92% between regions, varying greatly depending on season and online generation dispatch

Transmission May Not Always be a Solution

- New transmission will not always increase transfer capability
- Voltage and dynamic stability limitations will determine how much power can be transferred

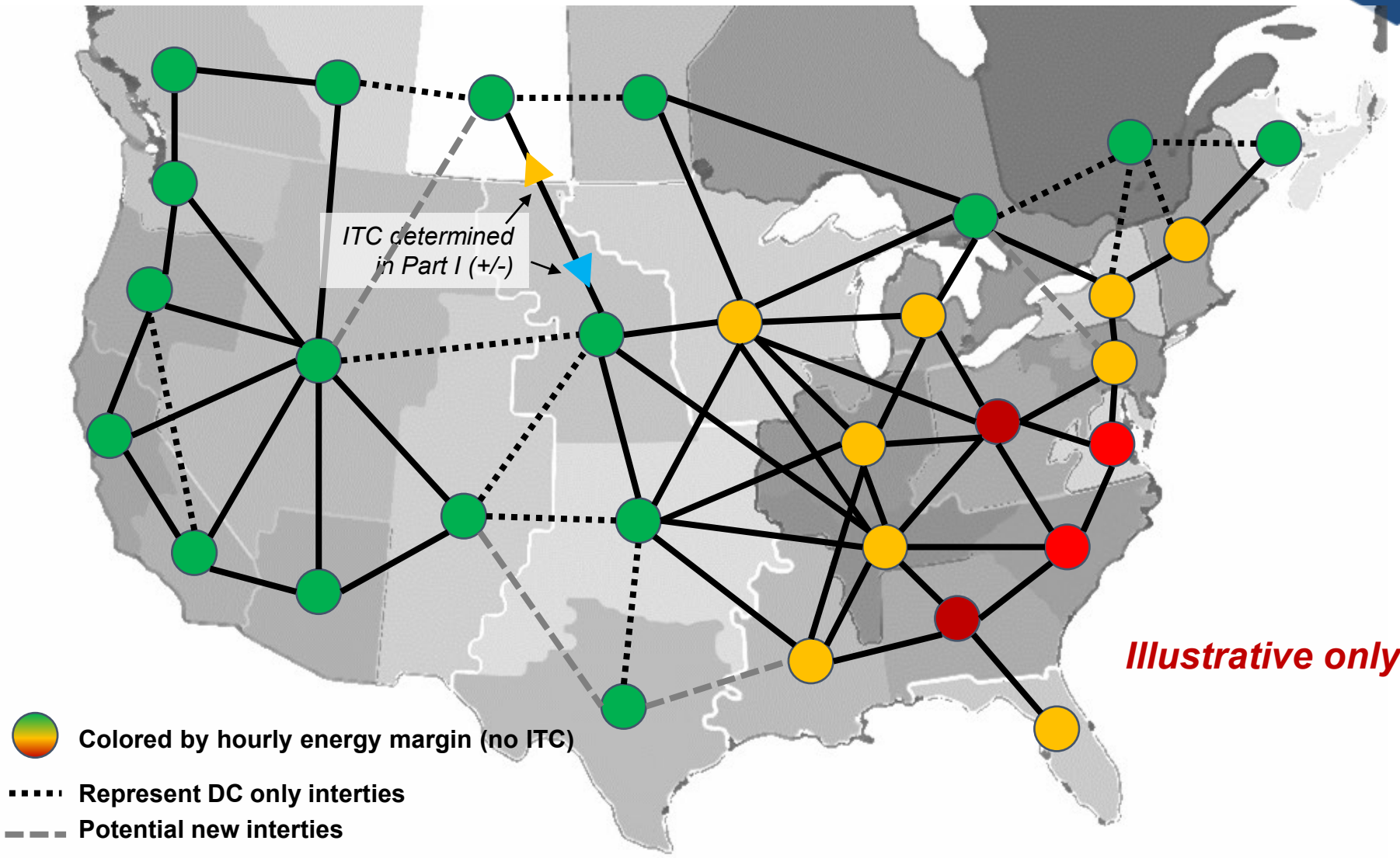
Resource Evaluation Cannot be Overlooked

- Many areas do not have sufficient committed generation to meet demand under extreme conditions (2034)
- Canadian system critical to this evaluation

Higher TTCs Will Require Significant Planning and System-Wide Reinforcements

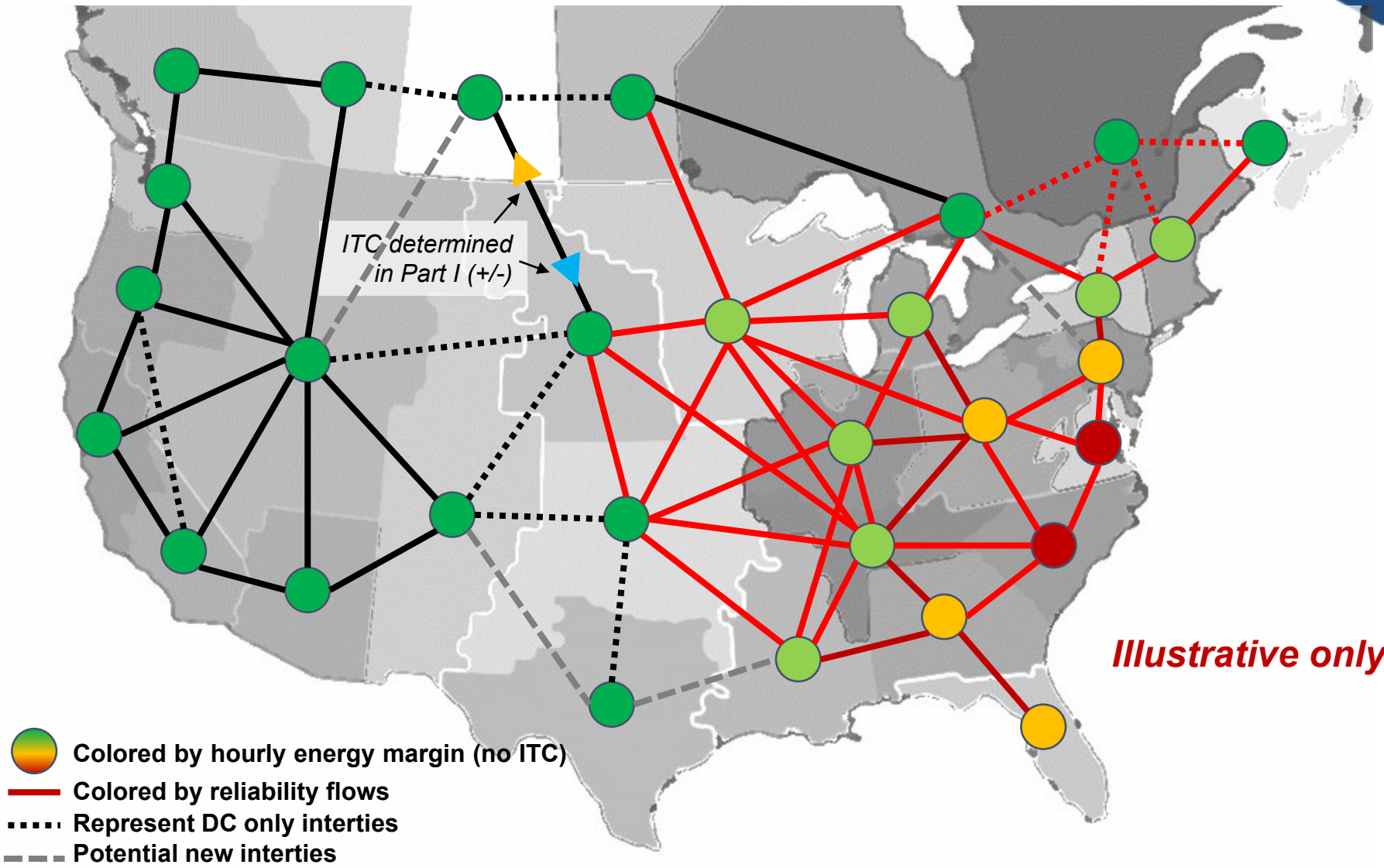
- TTC additions will require more granular stability studies once specific projects are evaluated
- Meaningful TTC additions will not be completed by 2034 without regulatory/legislative changes

Pipe and Bubble Model

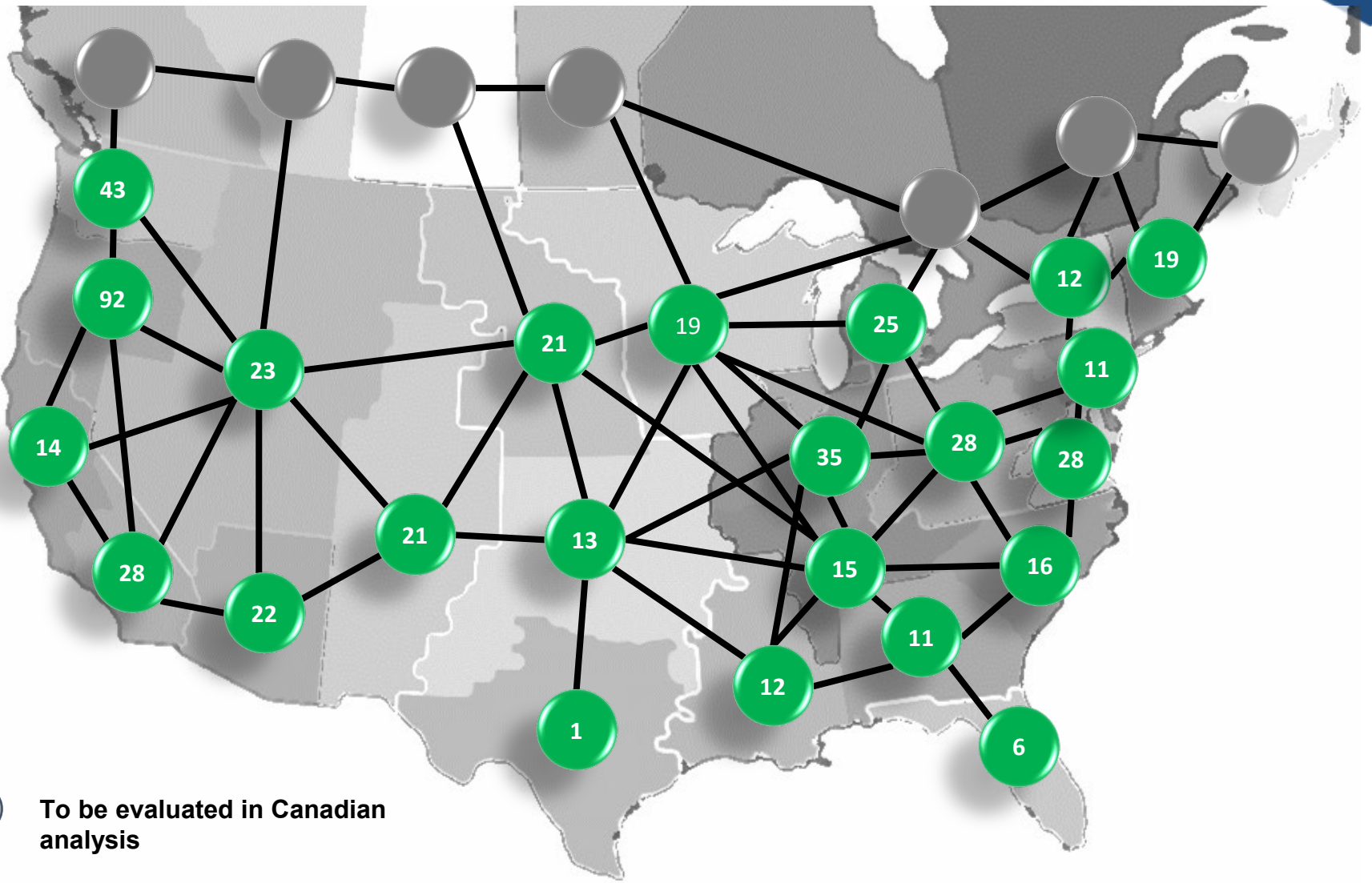


Illustrative only

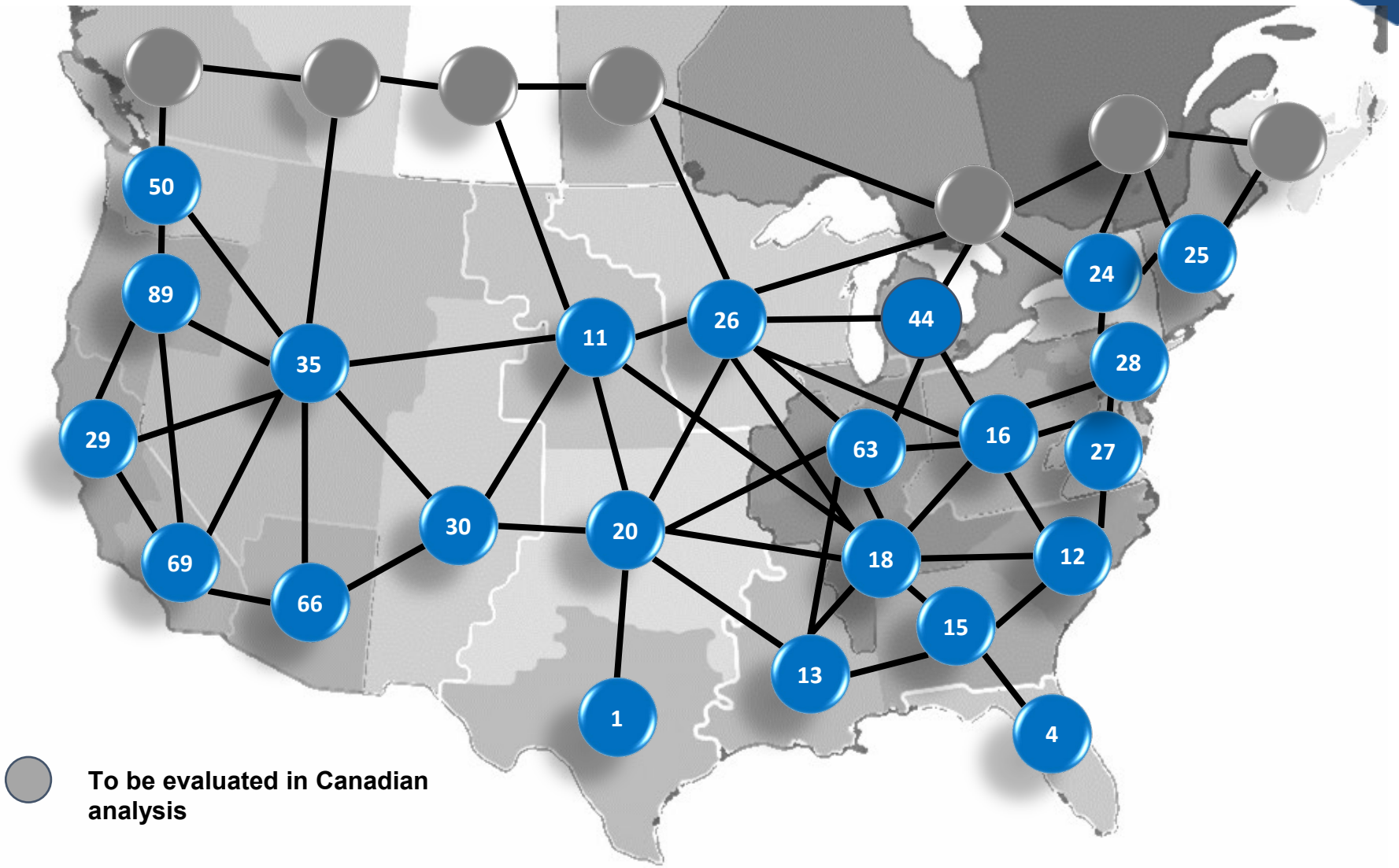
Pipe and Bubble Model



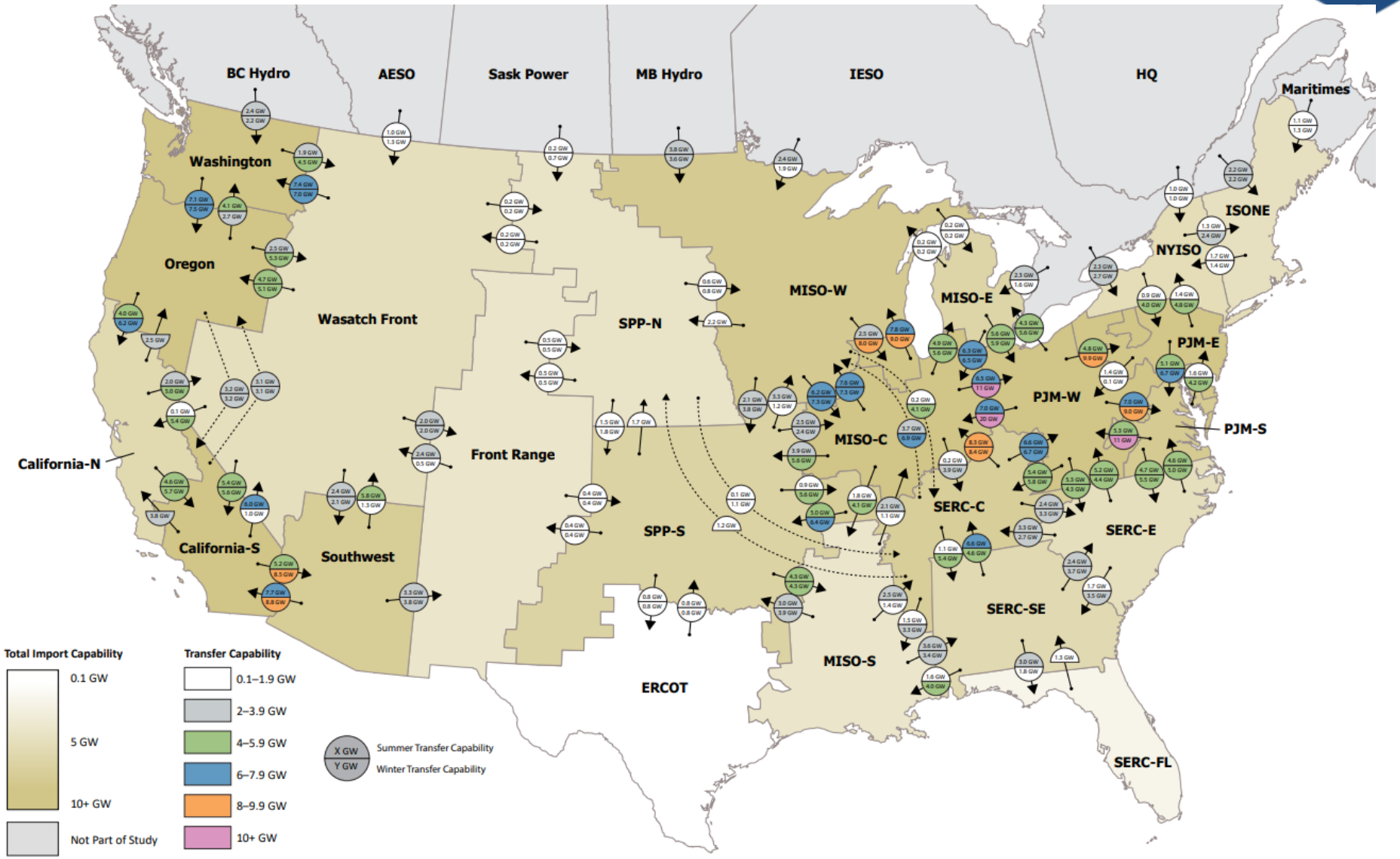
Part I Total Import Capabilities as Percentage of 2024 Peak Load (Summer)



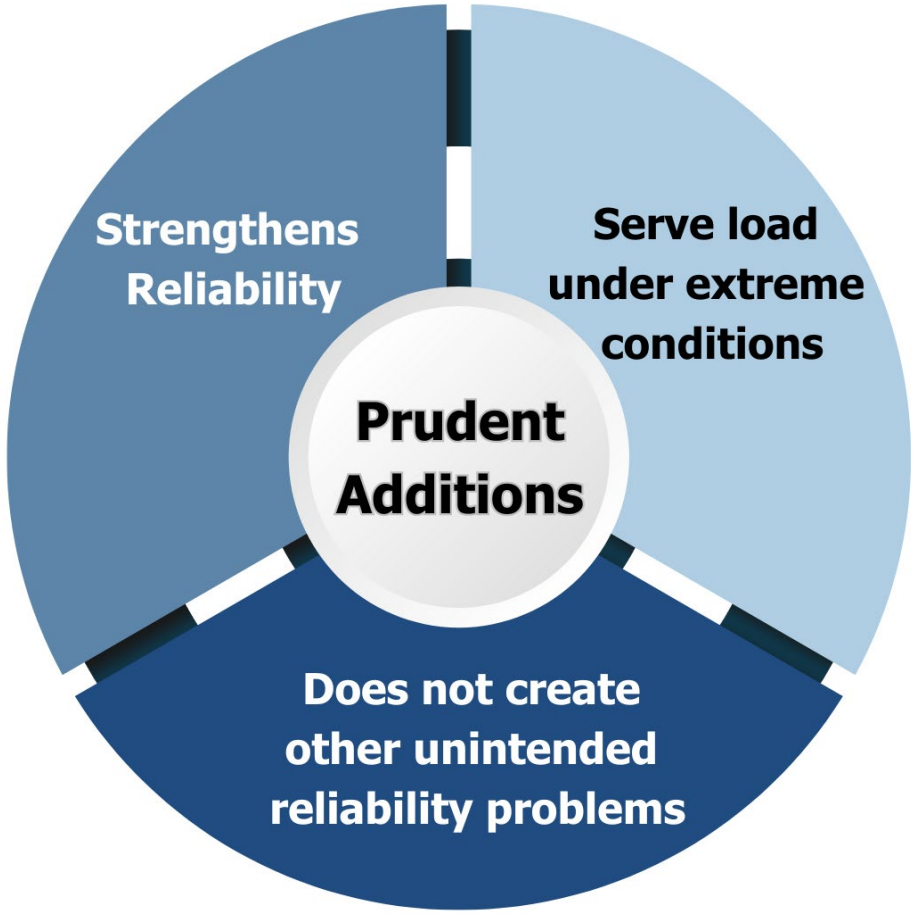
Part I Total Import Capabilities as Percentage of 2024 Peak Load (Winter)



Calculated Transfer Capabilities – 2024/2025 Base Case

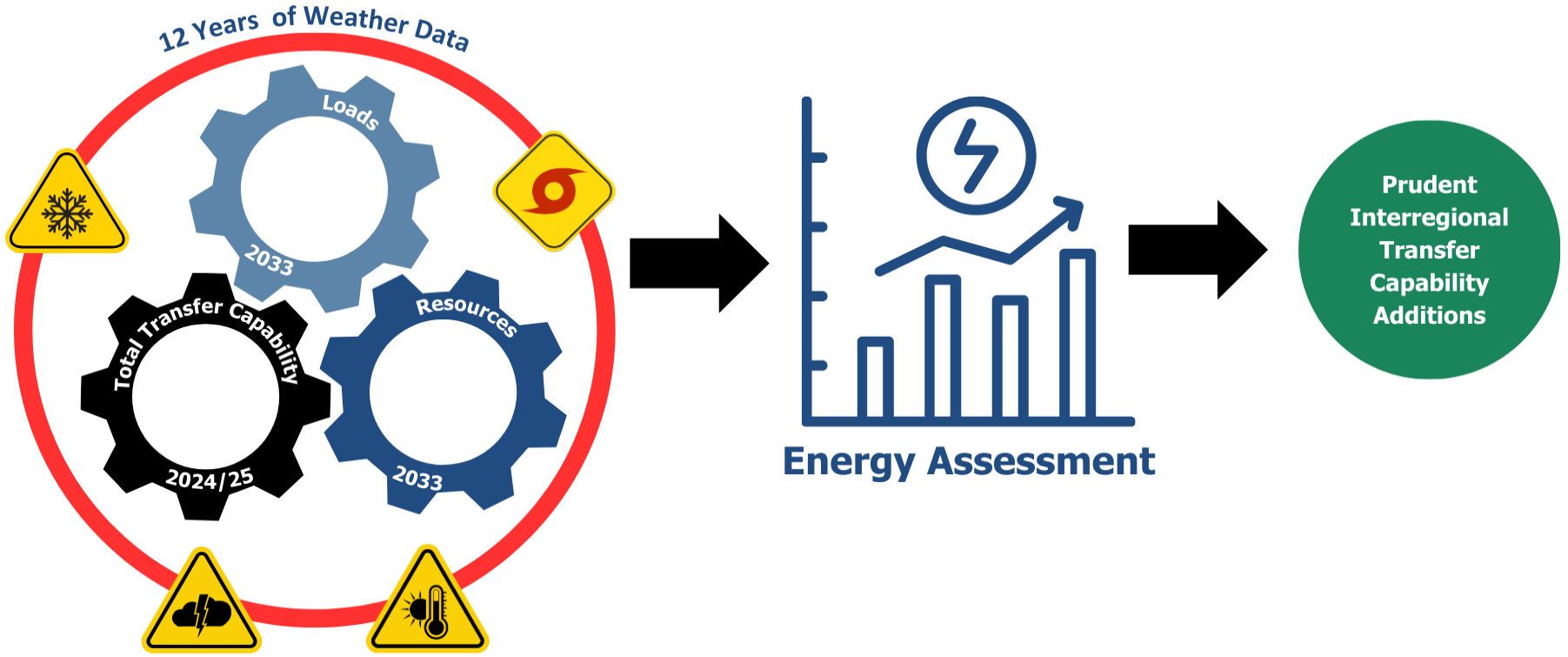


What is Technically Prudent Additions to Transfer Capability?



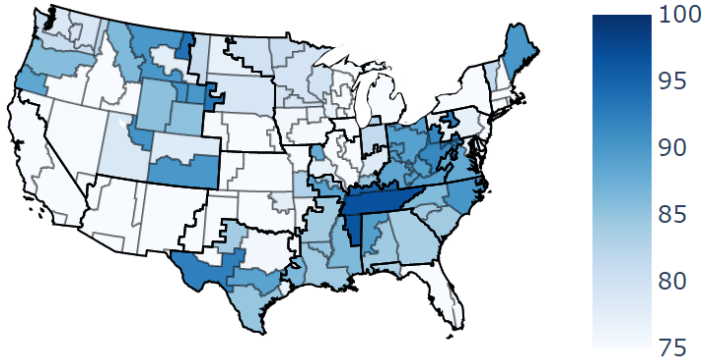
FERC precedent provides that "prudence" means a determination of whether a reasonable entity would have made the same decision in good faith under the same circumstances, and at the relevant point in time.

Part II: Prudent Additions Recommendations

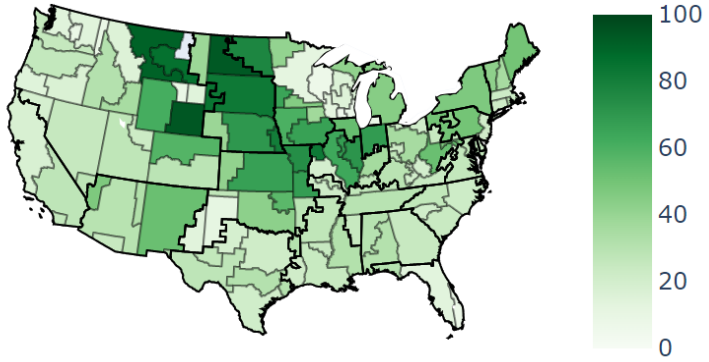


Energy Assessment: Cold Snap Example

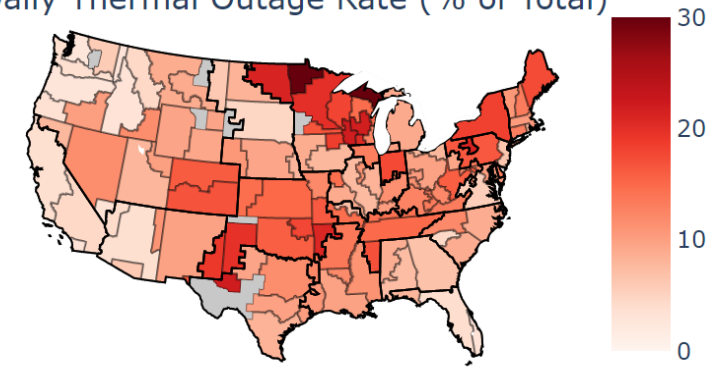
Maximum Daily Load (% of Annual Peak)



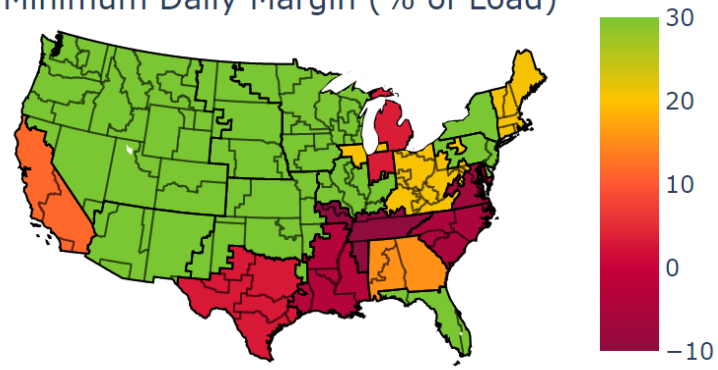
Average Daily Wind & Solar Capacity Factor (%)



Daily Thermal Outage Rate (% of Total)

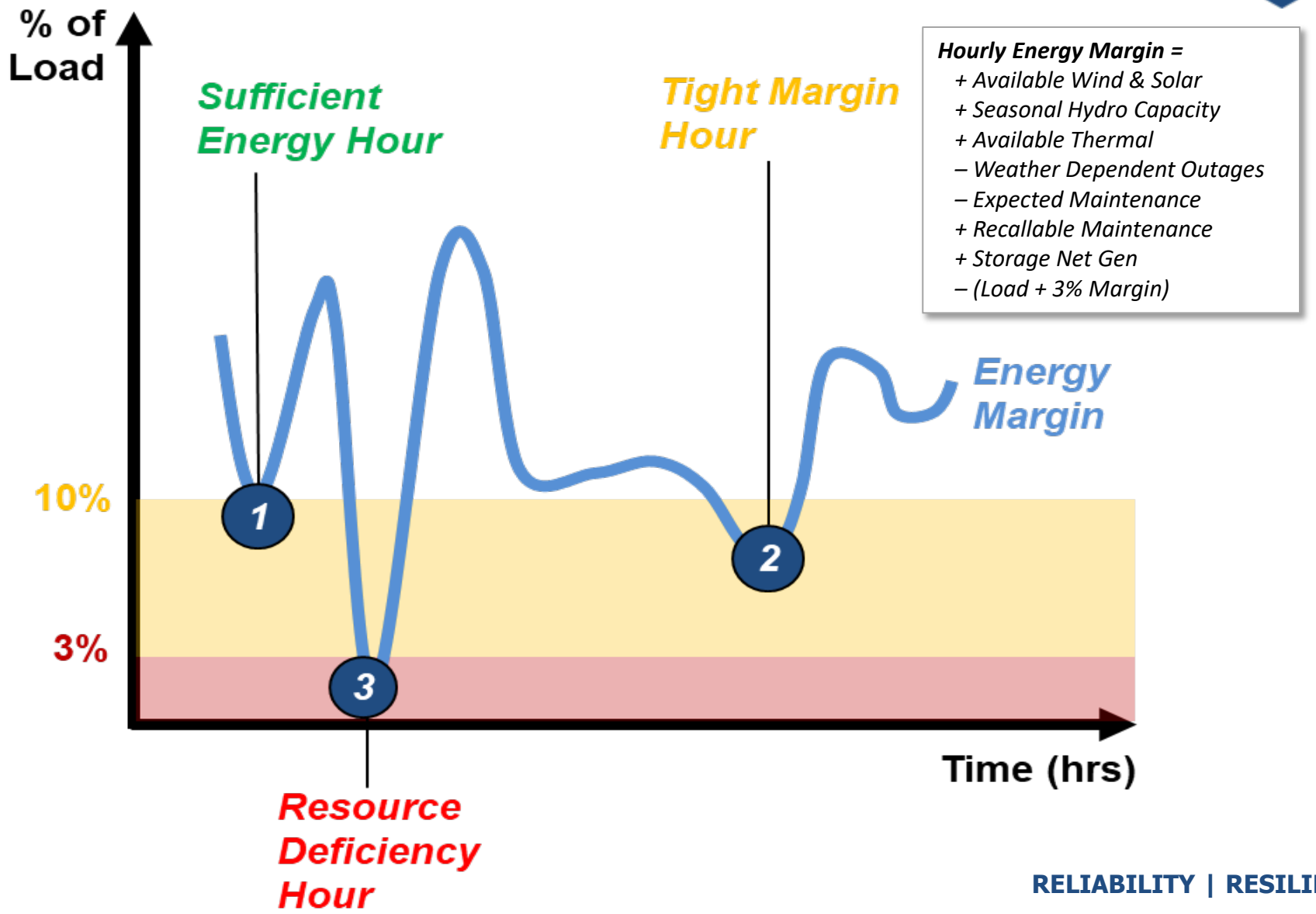


Minimum Daily Margin (% of Load)

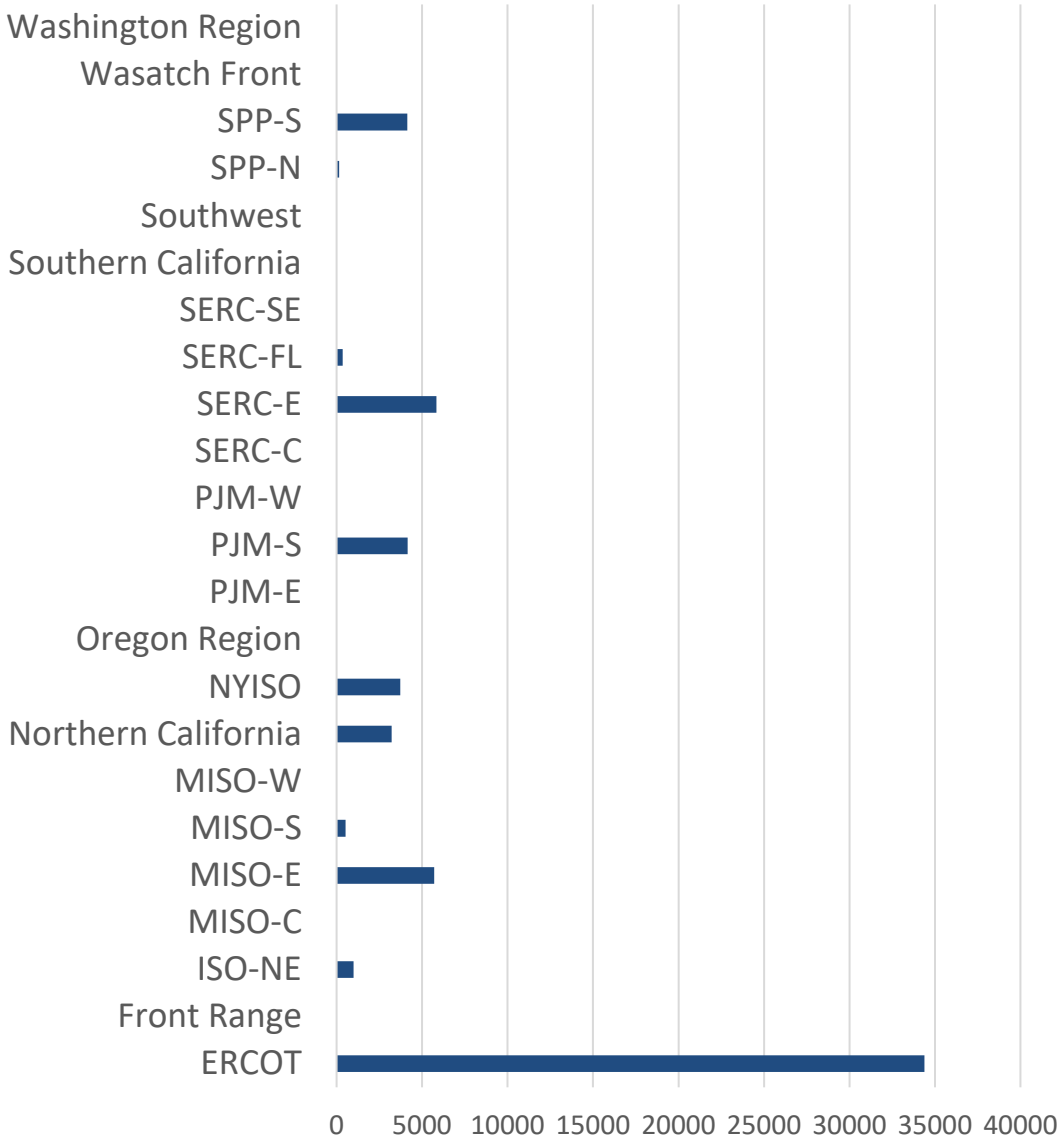


Source: ESIG Transmission Resilience Task Force (Telos Energy)
https://www.esig.energy/transmission-resilience/

Energy Assessment to Identify Prudent Additions

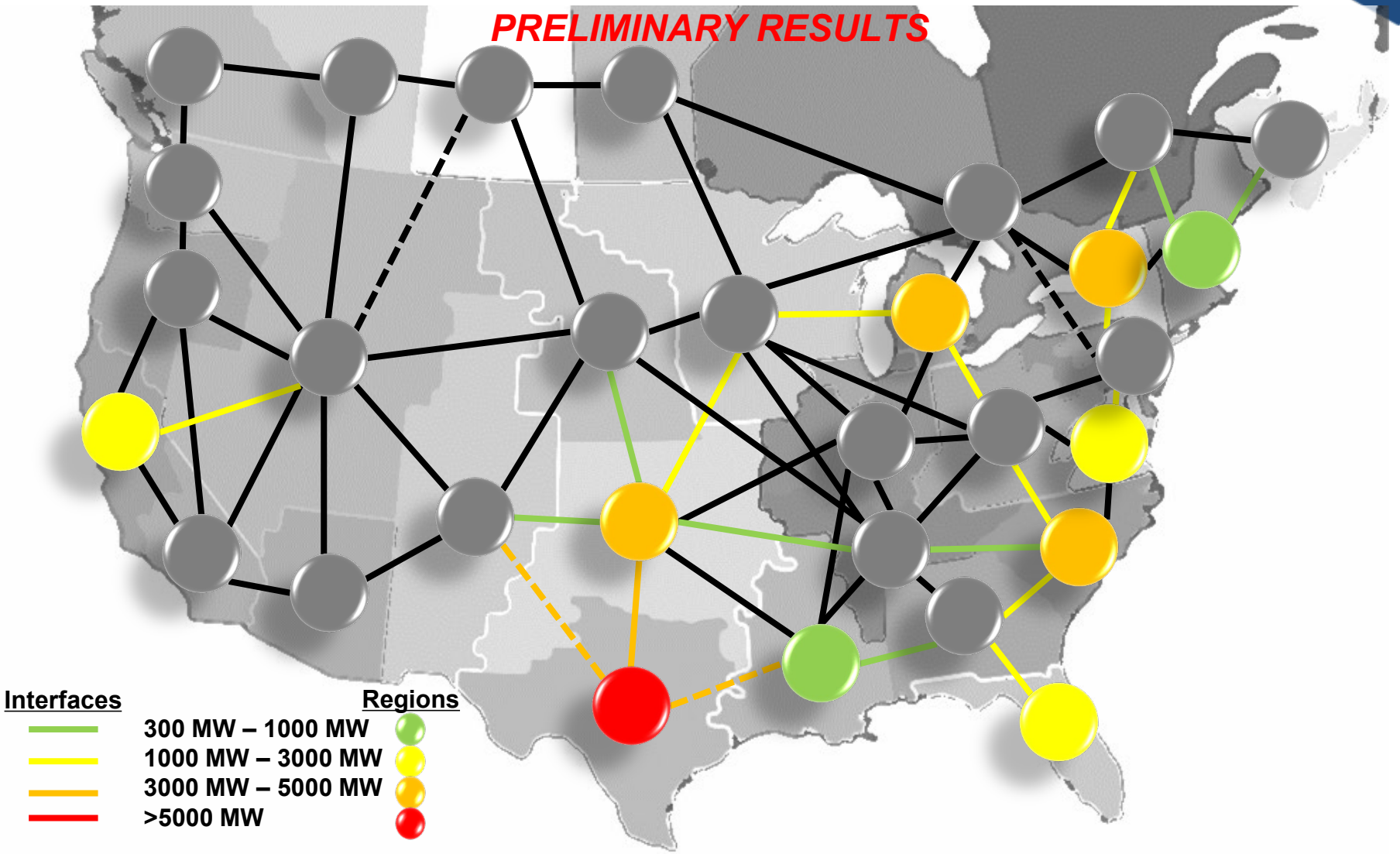


Energy Assessment Maximum Deficiency Identified (Preliminary)



- Capacity expansion determined by projections in Long-Term Reliability Assessment
- Tightening energy margins driven:
  - assumed extreme weather conditions
  - increased load growth
  - on-going retirement of conventional generation
  - shift toward a higher proportion of variable (wind and solar)
  - energy-limited resources (e.g., battery storage).
- Number of hours in these conditions range from 1-20

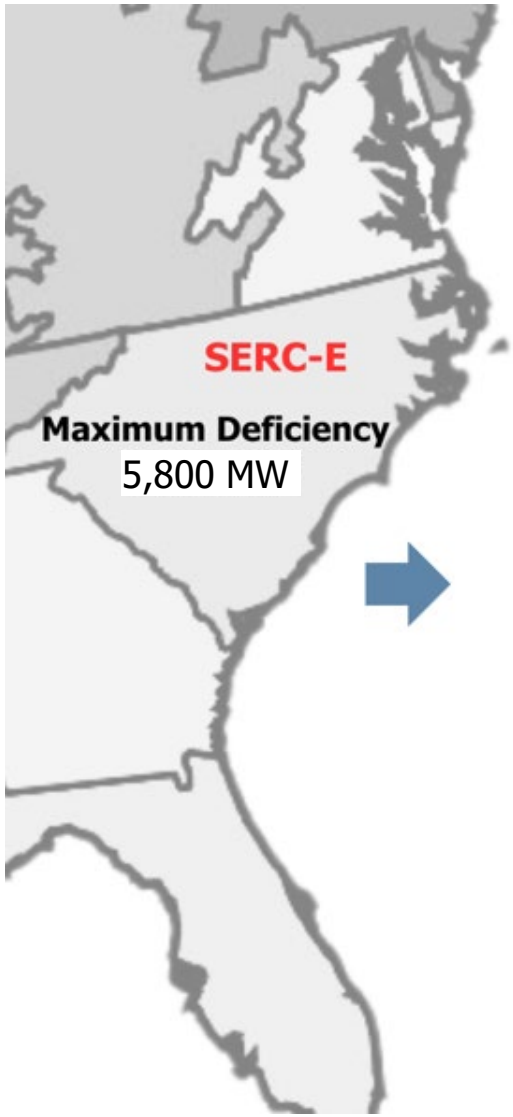
Summary of Prudent Additions (Preliminary)



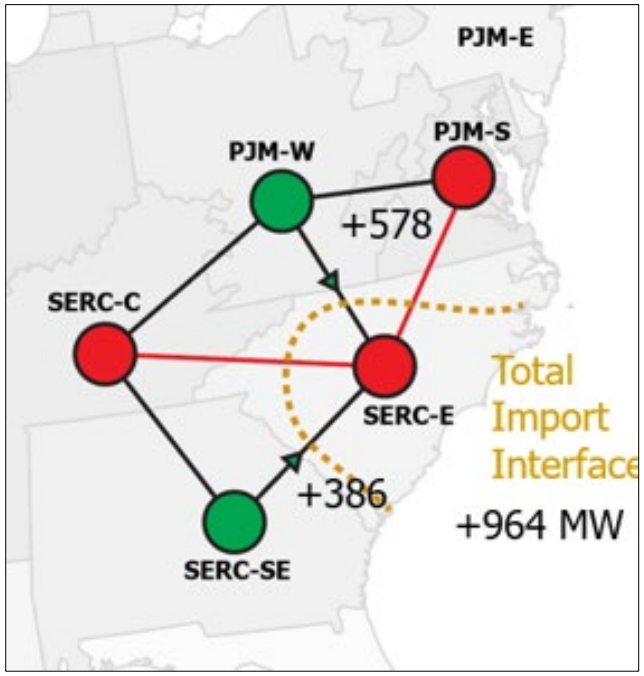
Recommended Prudent Additions (Preliminary)

Recommended Prudent Additions				
Transmission Planning Region	**Events / Drivers**	**Event Seasons**	**Interface for Additions**	**Prudent Addition Recommendation (MW)**
Northern California	2022 Heat Wave	Summer	Wasatch Front	1,100
ERCOT	Winter Storm Uri (2021) and four other events	Summer and Winter	Front Range, MISO-S, SPP-S	14,100
SPP-S	Winter Storm Uri (2021)	Winter	ERCOT, Front Range, MISO-W, SERC-C, SPP-N	4,200
MISO-E	2020 and two other events	Summer	MISO-W, PJM-W	3,000
MISO-S	2009 and 2011	Summer	ERCOT, SERC-SE	600
SERC-FL	2021 and two other events	Summer and Winter	SERC-SE	1,400
SERC-E	Winter Storm Elliott (2022)	Winter	PJM-W, SERC-C, SERC-SE	4,100
PJM-S	Winter Storm Elliott (2022)	Winter	PJM-E	2,800
NYISO	2023 Heat Wave and five other events	Summer	PJM-E, Québec	3,100
ISONE	2012 and two other events	Summer	Québec, Maritimes	700
Total Prudent Additions Recommendations				35,100

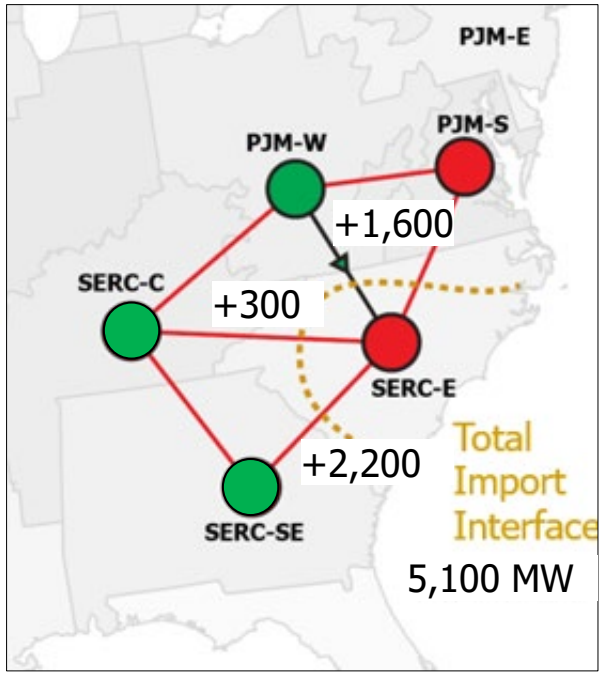
Example of Prudent Addition Analysis: SERC-E (2034)



First Iteration: Utilize Existing Import Capability and Excess Available Generation from Neighbors



Third Iteration: Maximum Support from Neighbors, Prioritized by Excess Available Generation



1,000 MW of Existing Import Capability + 4,100 MW of Prudent Additions = **5,100 MW of Needed Import Capability** from PJM-W, SERC-C, and SERC-SE

A Changing Context for the BPS in a Hyper Complex Risk Environment

Must Wins:

1. **Build more capacity and manage the pace of transformation** through market mechanisms and inter-agency coordination on policies that impact generation.
2. Ensure a robust **energy supply chain** for the balancing resources, with sufficient access to fuel and stored energy to withstand long-duration, wide-spread extreme weather events
3. Develop sufficient **transmission**, to integrate renewables and distribute them, make the system more resilient
4. Maintain a robust fleet of **balancing resources**, with an ability to provide **Essential Reliability Services** to ensure inverter-based resources don't negatively impact reliability
5. **STATES:** Refine resource adequacy requirements that preserves energy assurance

Questions and Answers

FORWARD TOGETHER RELIABILITYFIRST

HOW TO DEVELOP A RESPONSIVE WORKFORCE TO ADDRESS THE THREATS OF THE FUTURE

TIM CONWAY

Technical Director, ICS at SANS Institute

SANS

How to Develop a Responsive Workforce to Address the Threats of the Future

AKA: Workforce for Today and Tomorrow

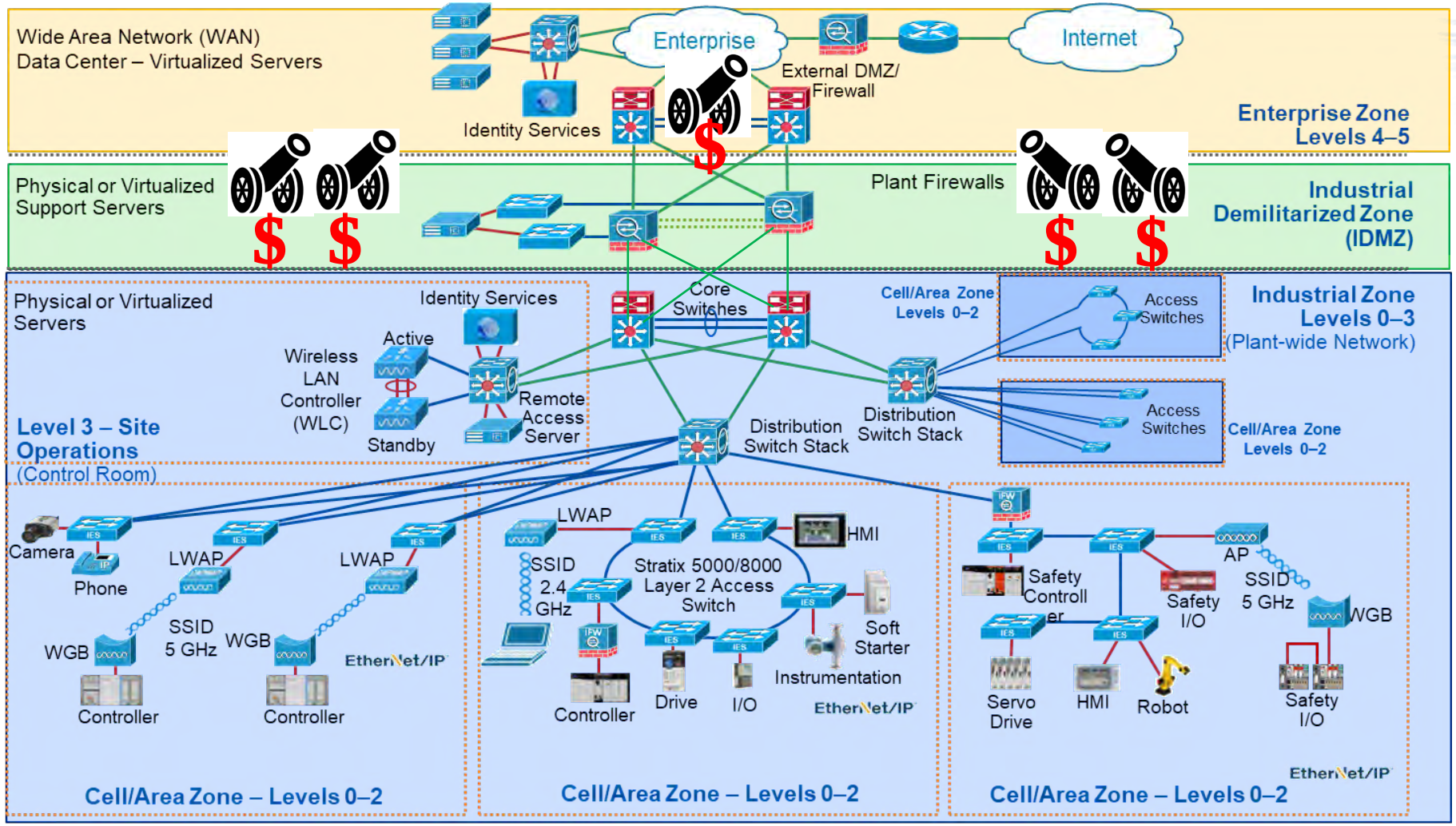
Tim Conway

– SANS Institute ICS Curriculum

– Senior Instructor

– Course Author

Threats of the Future?



Offensive Progressions

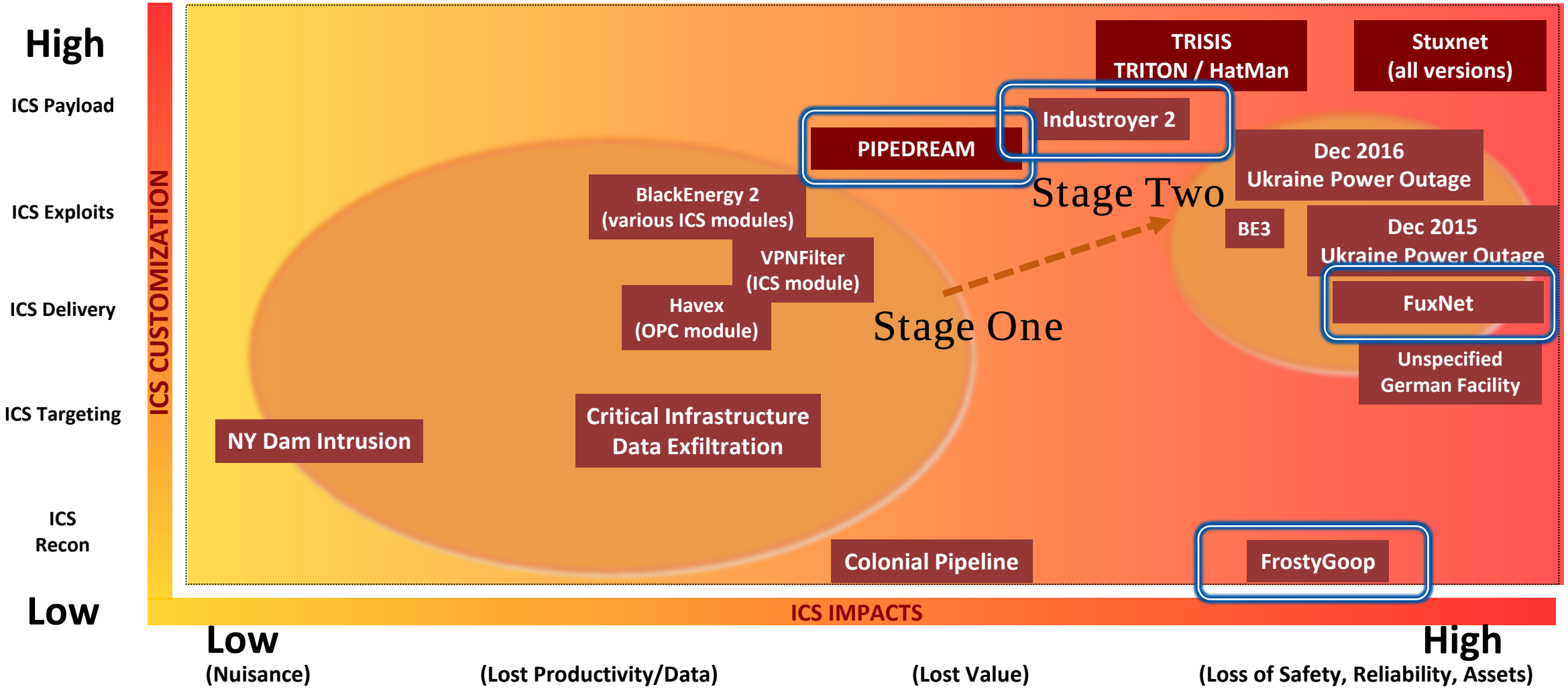
Critical Infrastructure targeting

Progression in All Categories

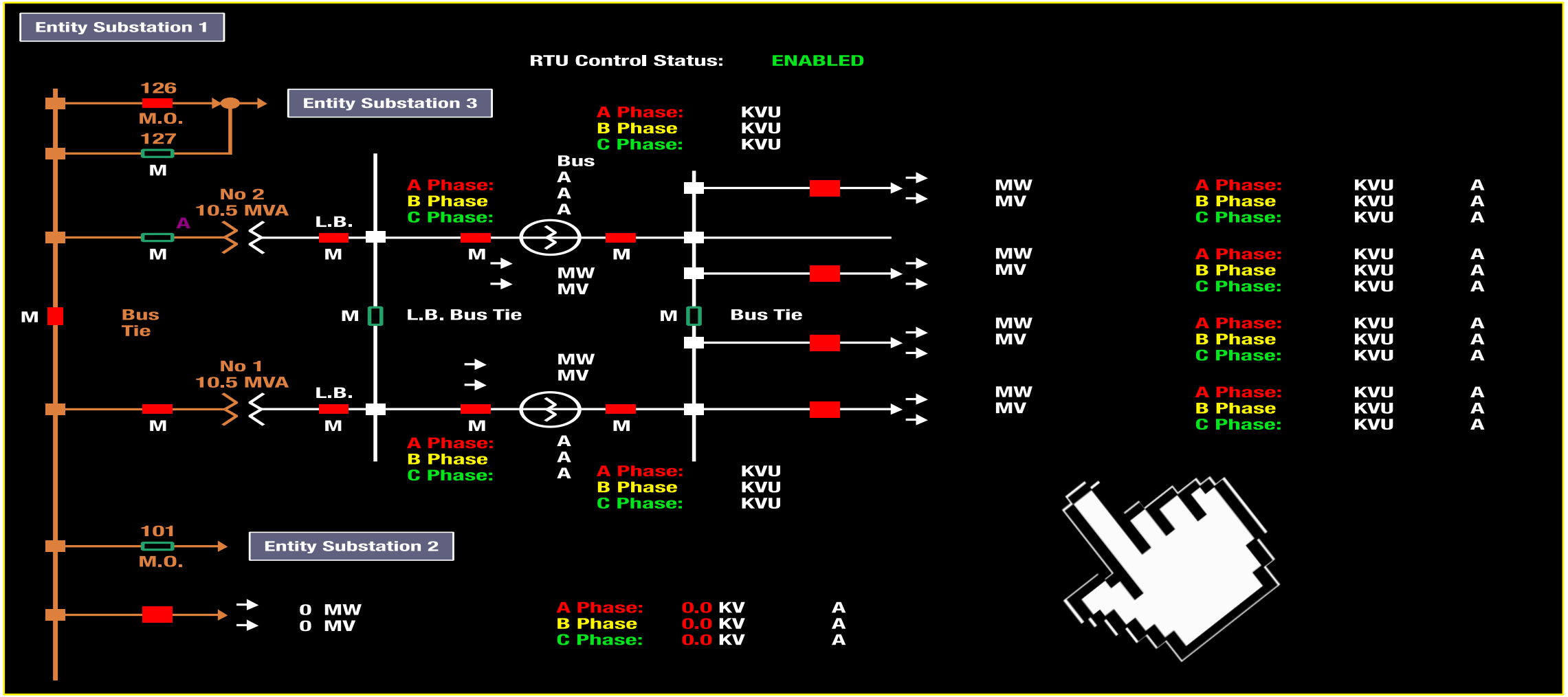
Governance,
Standards,
Regulation,
Architecture,
Cyber Hygiene,
Passive Defense

Operations
Resilience,
Cyber Engineering,
Active Defense

ICS Incidents & Access Campaigns



Electric System Cyber Attacks



Malware Discovery Associated with Electric Outages

Russia has developed a cyberweapon that can disrupt power grids, according to new research

The malware, dubbed CrashOverride, is just the second instance of malware specifically tailored to disrupt or destroy industrial control systems, according to new research. The Washington Post's Ellen Nakashima explains. (The Washington Post)

By Ellen Nakashima June 12 at 4:20 PM

Hackers allied with the Russian government have devised a cyberweapon that has the potential to be the most disruptive yet against electric systems that Americans depend on for daily life, according to U.S. researchers.

ANDY GREENBERG SECURITY 06.13.17 12:41 PM

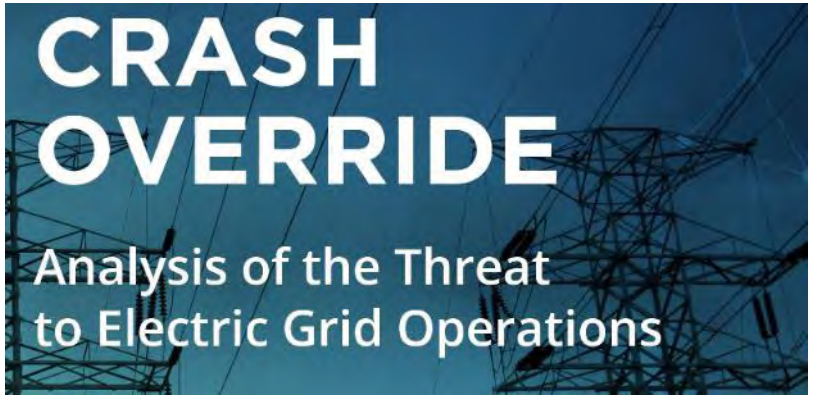
'CRASH OVERRIDE': THE MALWARE THAT TOOK DOWN A POWER GRID

Cyber firms warn of malware that could cause power outages

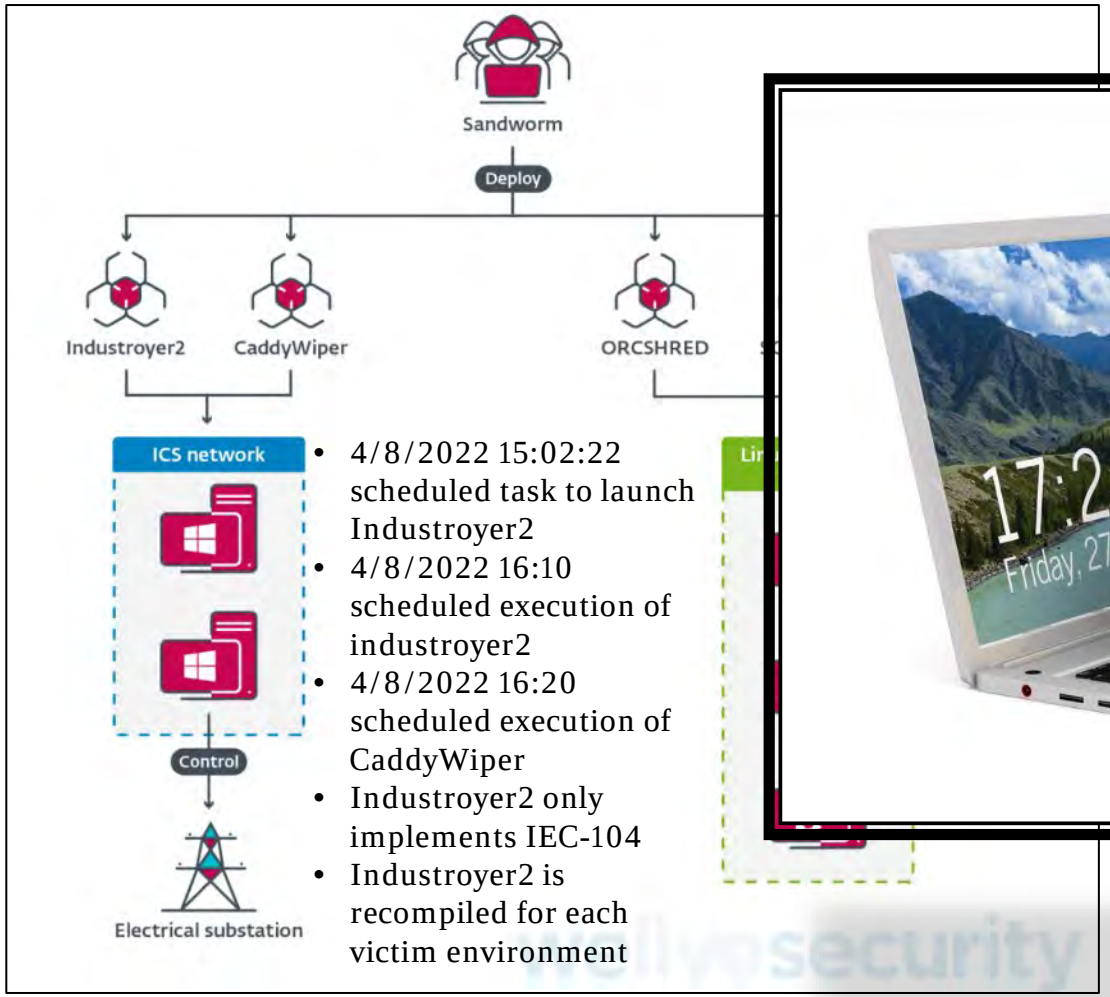
INDUSTROYER

ESET ENJOY SAFER TECHNOLOGY™

DRAGOS



Two in a Month – Anticipate Many More



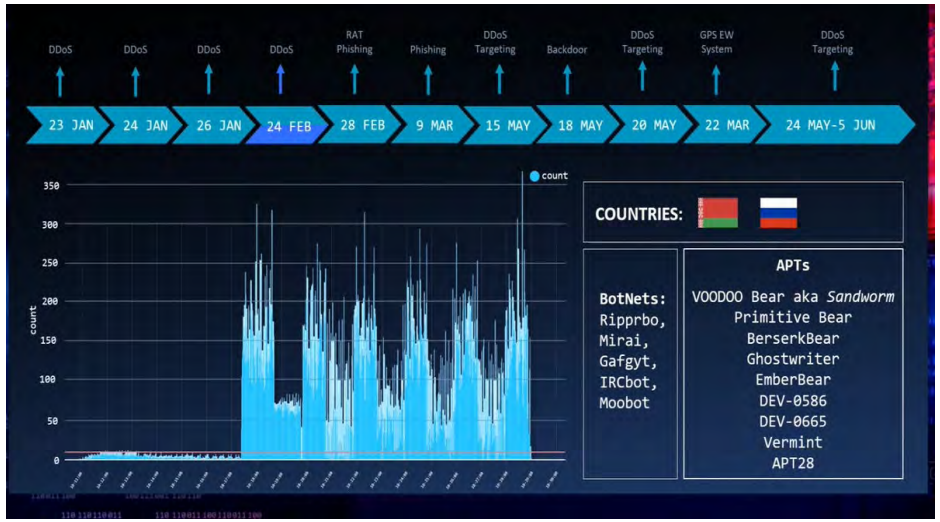
- 4/8/2022 15:02:22 scheduled task to launch Industroyer2
- 4/8/2022 16:10 scheduled execution of industroyer2
- 4/8/2022 16:20 scheduled execution of CaddyWiper
- Industroyer2 only implements IEC-104
- Industroyer2 is recompiled for each victim environment

Past, Present, and Future

- Ongoing coordinated cyber & physical attacks
- Critical Infrastructure impacts enabling invasion and entrenchment

- Positioning, capability validation, effects-based attacks
- Targeted service outages and equipment damaging attacks

Coordinated Cyber & Physical Attacks



Defensive Progression Needed

Experts at operating complexity, need to consider misuse

What Would You Say You Do Here?

Leaders

+ Compliance
+ Cybersecurity

Step up
Step over
Build and Manage a Team
Pursue executive support
Enable the team

Operators

+ Compliance
+ Cybersecurity

Know the system
Know the tools
Normal / Conservative / Emergency Op
Restoration and response with technology impacts

Physical Security

+ Compliance
+ Cybersecurity

Physical security monitor and defense
Site Assessment and remediation
Security incident response
Information sharing and ingest

IT / OT

+ Compliance
+ Cybersecurity

System / Network / Application build / support
Operational ICS System design / build / support
Cybersecurity defense /detection / response
Recovery / restoration
Information sharing and ingest

Safety First, Injuries Last

Regardless of Job title – everyone plays a role in cybersecurity and Compliance

Building a Cyber Skilled Workforce For Today and Tomorrow

Security Team Axioms

If you're lucky…

- you'll inherit a good team
- you'll get to choose your team
- you'll be able to build a good team

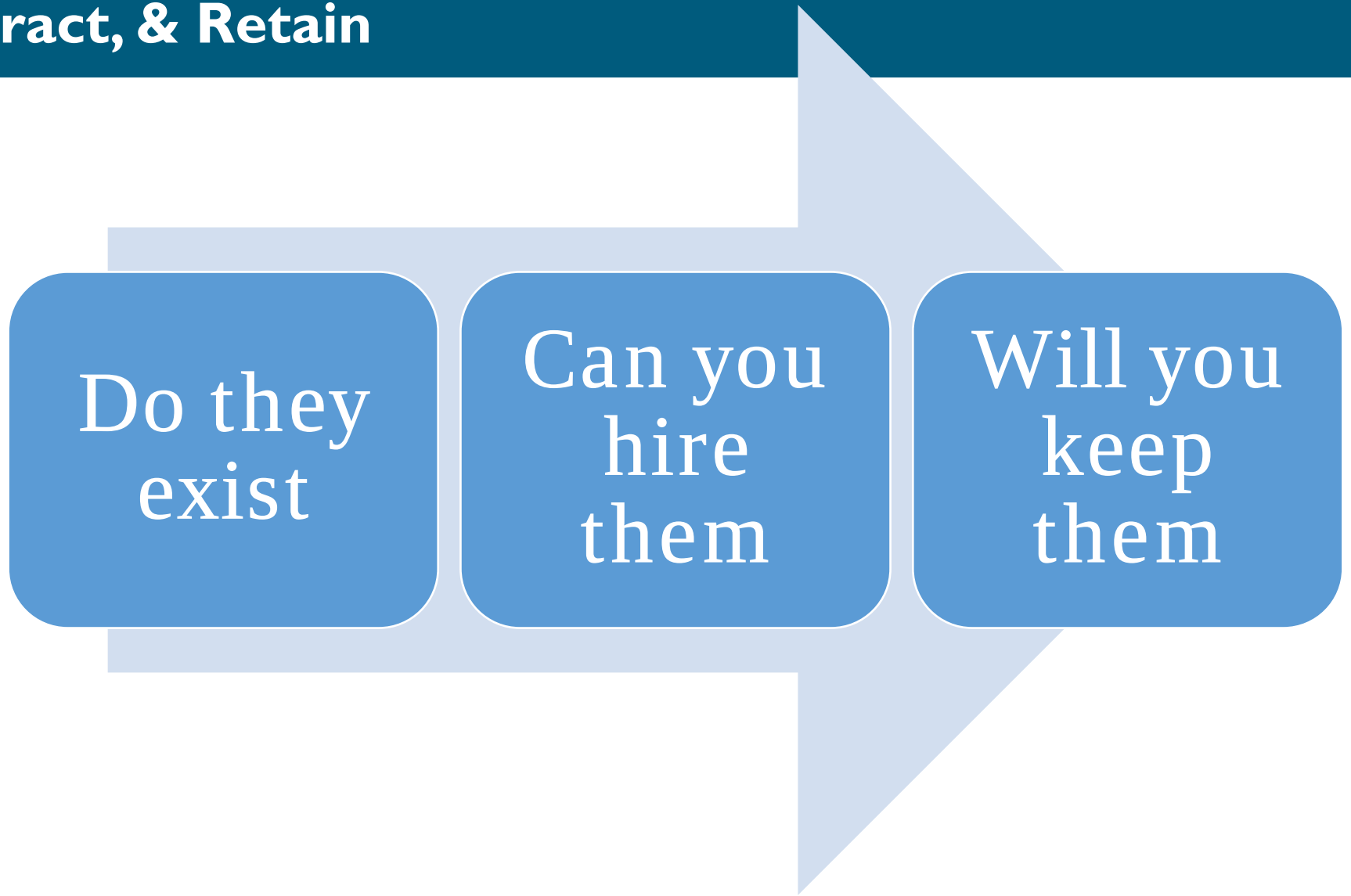
If you're good…

- you'll get to stick around
- your team may stick around
- Others will want to join your team

If your team is good…

- people will want to steal your team

Find, Attract, & Retain



What Capability Levels & How Many at a Given Level

ICS CYBERSECURITY SKILLSETS AND ROLES

ICS Knowledge Levels

As an ICS team's skillsets and roles are considered, the ICS Knowledge Levels can be used to guide the development plans for team members, tasks, roles, and responsibilities. Each knowledge level can be used to build a strong ICS security team and establish and mature an ICS security program.

Base Knowledge – LEVEL 0

Base knowledge training should focus on security behaviors for individuals who interact with, operate, or support industrial control systems. A training program may introduce ICSs, the risks or types of ICS attacks, basic system and network defenses and controls, as well as typical ICS governance and policy best practices. The training program's goal should be to change human behavior in an ICS environment and reduce risk at a fundamental level.

Foundational Knowledge – LEVEL 1

Foundational knowledge training should ensure the workforce involved in supporting and defending industrial control systems are trained to keep the operational environment safe, secure, and resilient against current and emerging ICS cyber threats. Across a diverse audience, this training level should build, develop, and ensure a common language in control systems and an understanding of the underlying engineering processes while providing an overview of the basic tools specific to ICS security across a wide range of industry sectors and applications.

Mastery Knowledge – LEVEL 2

Mastery knowledge training should be role-specific and focus on individuals and organizational needs to advance ICS cybersecurity defense knowledge, skills, and ability in a specific field, architect proper ICS network architecture, and conduct incident response and recovery practices with engineering teams.

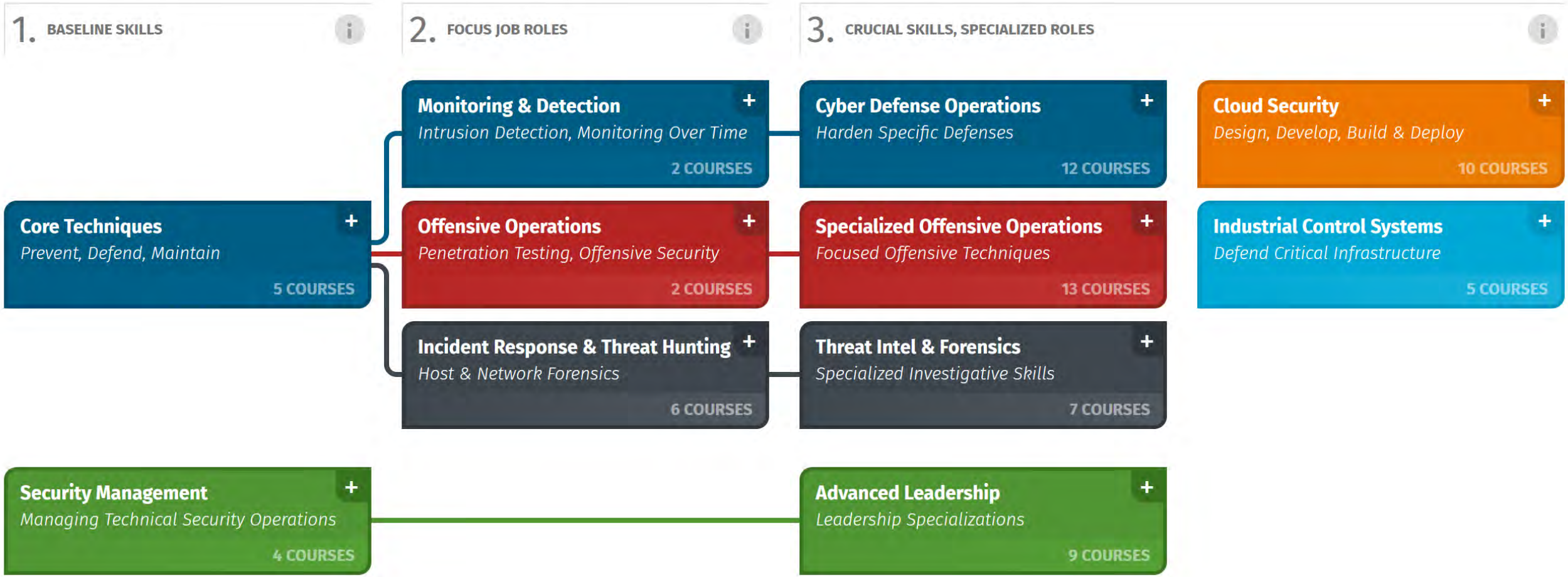
Expert Knowledge – LEVEL 3

Expert knowledge training should focus on coordinated industrial advanced incident response and improving team capabilities and toolsets. Expert training typically consists of joint exercises and projects with engineering and other facility teams.

Leader – LEVEL 4

ICS cybersecurity leadership training should focus on technical team development and leadership, risk management, approaches for building relationships with other teams, tracking meaningful metrics, maturing the overall ICS cybersecurity program, and communicating technical concepts to non-technical audiences, including reporting to the board.

One Provider – Cybersecurity Focused 75 Courses



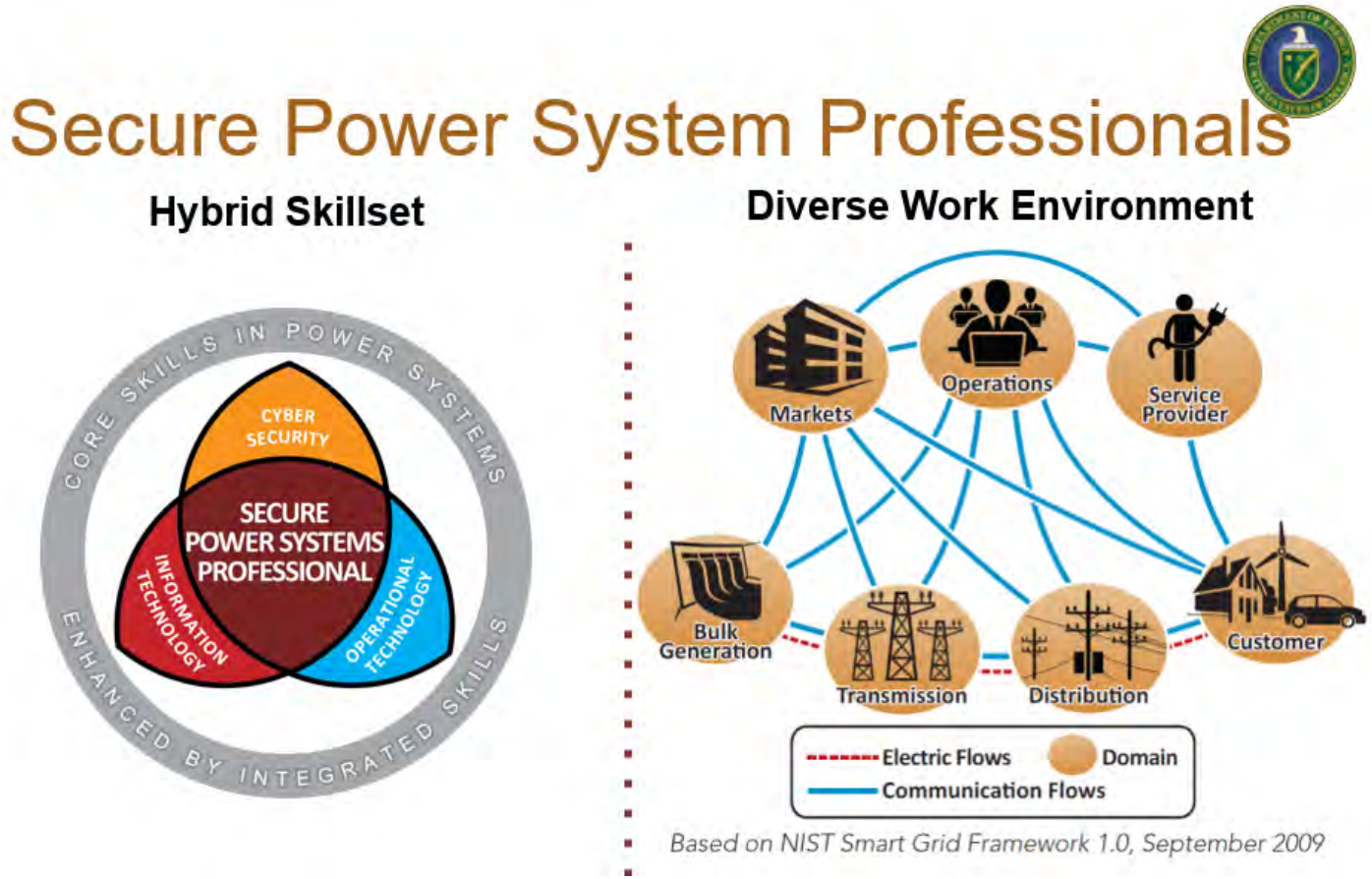
IT – Information Technology and OT Operational Technology

Data at rest, data in motion, and data in use

Data that does something in the physical world – kinetic component


COOLEST CAREERS IN CYBER
SANS | GIAC CERTIFICATIONS
Organizations are hiring individuals with a unique set of skills and capabilities, and seek those who have the abilities and knowledge to fulfill many new job roles in the cybersecurity industry. The coolest careers in cybersecurity are the most in demand by employers. Which jobs are the coolest and most in demand? We know, so let us show you the hottest cybersecurity jobs for 2024.
Curricula: New2Cyber Cyber Defense Digital Forensics Offensive Operations Cybersecurity Leadership Cloud Security Industrial Control Systems Purple Team
GIAC Certification with course
01 Threat Hunter (Threat/Warning Analyst)
02 Red Teamer (Adversary Emulation Specialist)
03 Digital Forensic (Cyber Defense Forensics Analyst)
04 Purple Teamer
05
06 Chief Information Security Officer (CISO) (Executive Cyber Leadership)
07 Blue Teamer – All-Around Defender (Cyber Defense Analyst)
08 Security Architect (NICE) and Engineer
09 Cyber Defense
10 Cybersecurity Analyst/Engineer (Systems Security Analyst)
11 OSINT Investigator/Analyst
12 Technical Director (Information Systems Security Manager)
13 Cloud Security Analyst
14 Intrusion Detection/SOC Analyst (Cyber Defense Analyst)
15 Security Awareness Officer (Security Awareness & Communications Manager)
16 Vulnerability Researcher & Exploit Developer (Vulnerability Assessment Analyst)
17 Application Pen Tester (Secure Software Accessor)
18 ICS/OT Security Assessment Consultant (ICS/SCADA Security Engineer)
19 DevSecOps Engineer (Information Systems Security Developer)
20 Media Exploitation Analyst (Cyber Crime Investigator)
Why is this role important?
Recommended courses

Blending Skill Sets



#1 Area of Concern - Workforce (Highlighted in International Work Group)

Risk of operations disruption due to a lack of personnel with in-depth knowledge of complex energy systems and cyber security

Examples:

- *Operators and engineers may not fully understand the cyber security implications of their actions*
- *Personnel may be unable to detect early signs of a cyberattack, hindering rapid response*
- *Skilled personnel are needed to manage legacy industrial control systems effectively*

Consequences:

- *Unintentional system shutdowns or malfunctions due to misconfigurations*
- *Prolonged downtime due to slow resolution of cyber incidents*
- *Increased attack surface for the attackers to exploit*

Capability Focus

- Ongoing activity in region assisting Critical Infrastructure asset owners and operators since 2015
- Hundreds of courses allocated across various gov orgs
- Last 24 months of activity have also focused on regional Workshops

Topic Areas Covered in Workshops

- Practical Open Source Intelligence Techniques For Defence
- Debunking disinformation and finding hate groups with OSINT

OSINT

- CTI in times of conflict

CTI

- ICS intro, and trends
- ICS Defender focused actions

ICS

- ICS Security for Leaders and Managers

MGMT

- Defending Against State Sponsored Attackers

SEC

Department of Energy - Rural and Municipal Utility Cybersecurity (RMUC)

U.S. DEPARTMENT OF ENERGY
Office of Cybersecurity, Energy Security, and Emergency Response

INL Idaho National Laboratory

- Launched in 2023
- Event held in each of the six NERC regions and beyond
- Three days of training where attendees chose their own adventure
- Joint team training exercise on the final day
- Free for attendees

Roles and Responsibility Training Tracks

I am New to ICS

DAY 1

- ICS Foundations

DAY 2

- DOE CyberStrike

DAY 3

- Team Up & Learn / Share hands-on challenge

I am an ICS practitioner

DAY 1

- DOE CyberStrike

DAY 2

- Pick 2 Half-Day Workshops aligned with Job Role

DAY 3

- Test Your Skills & play as individual against peers

I am a Cybersecurity Professional

DAY 1

- ICS Foundations

DAY 2

- Pick 2 Half-day Workshops aligned with Job Role

DAY 3

- Team Up & Learn / Share hands-on challenge

I am in Leadership

DAY 1

- DOE CyberStrike

DAY 2

- OSINT & ICS Leadership Half-day Workshops

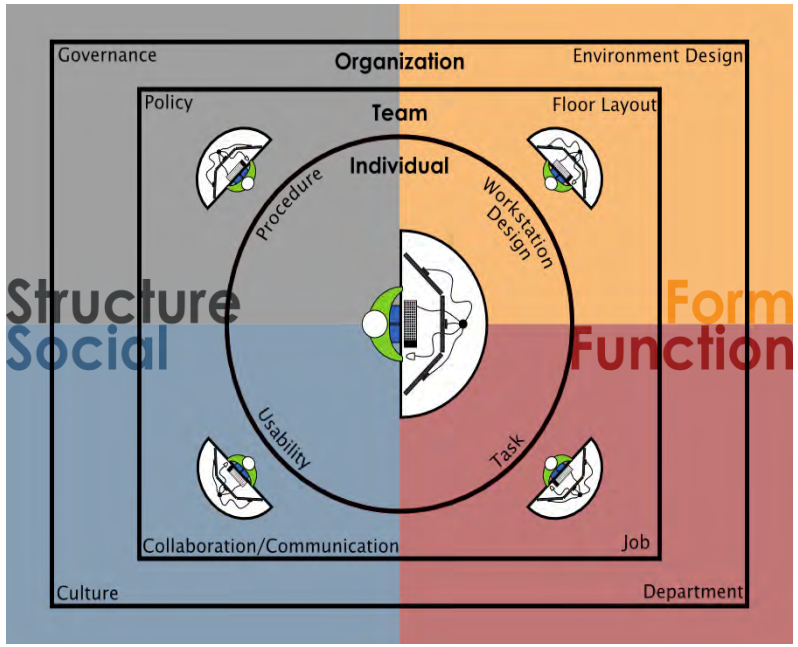
DAY 3

- Team Up & Learn / Share hands-on challenge

Exercises and Simulation

Practice the way you play

Operations Integrated Cybersecurity Training



- ❑ Complex system under control
- ❑ Multiple operator tools
- ❑ Variety of displays
- ❑ Various alarms and alert screens
- ❑ Distant from the environment under control
- ❑ Rapid decision making required

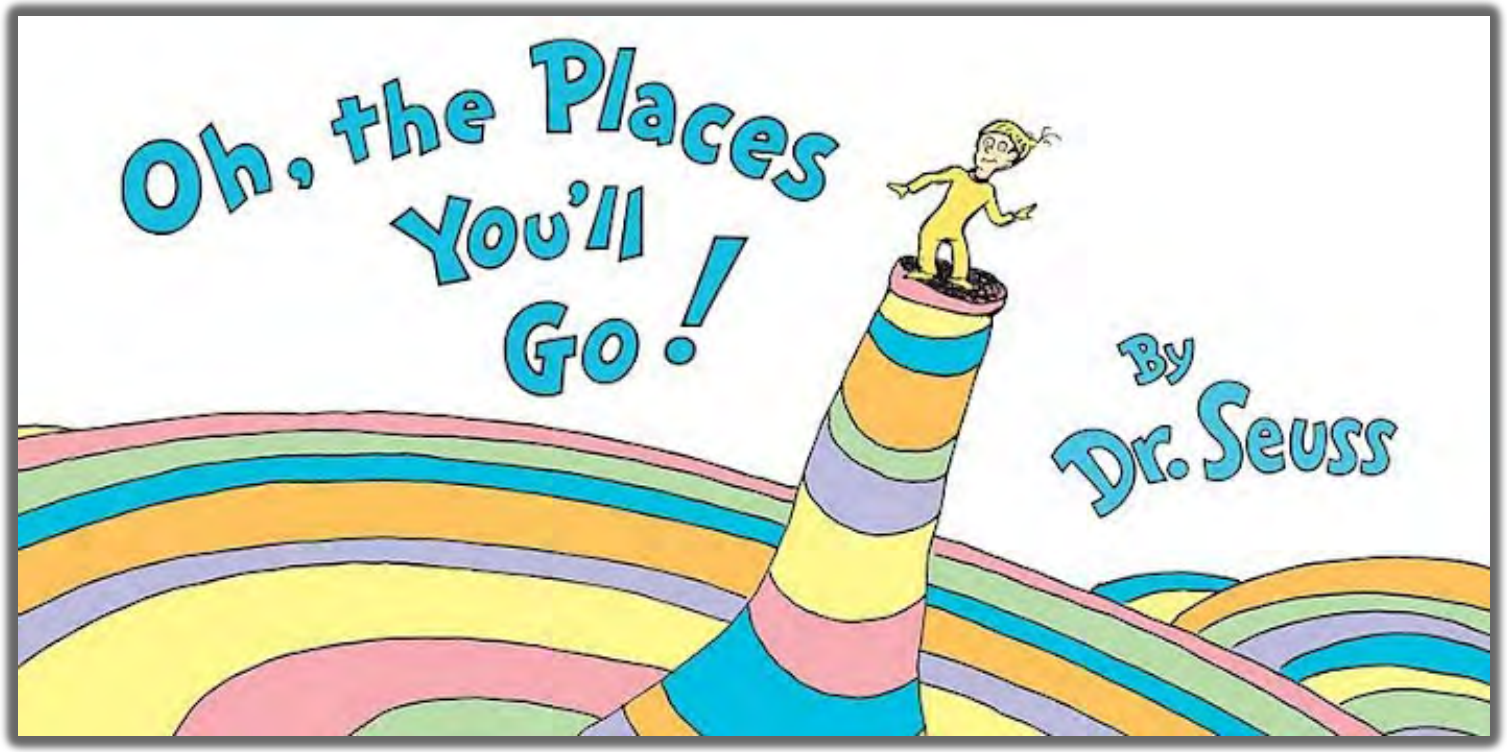
Exercise Goals – Learning Opportunities

Standards
Governance
Culture
System Design
System Maintenance
Architectures

Agility
Defense Capability
Plans
Procedures
Training
Exercises

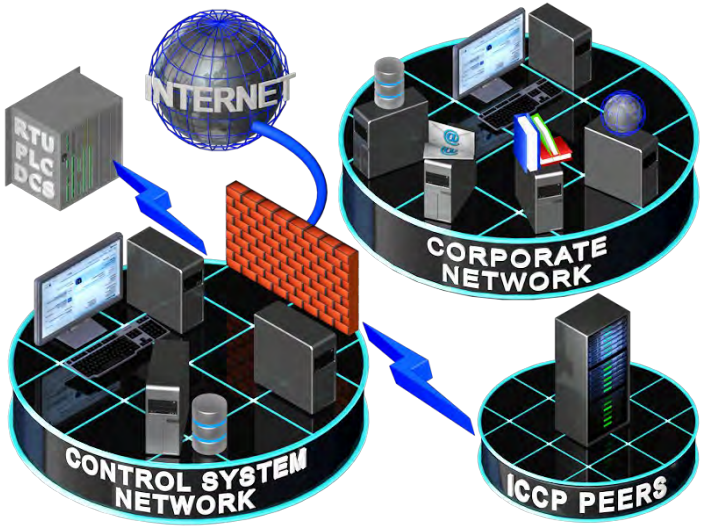
Information Sharing
Law Enforcement
Intelligence
Requests for Assistance
SLA's

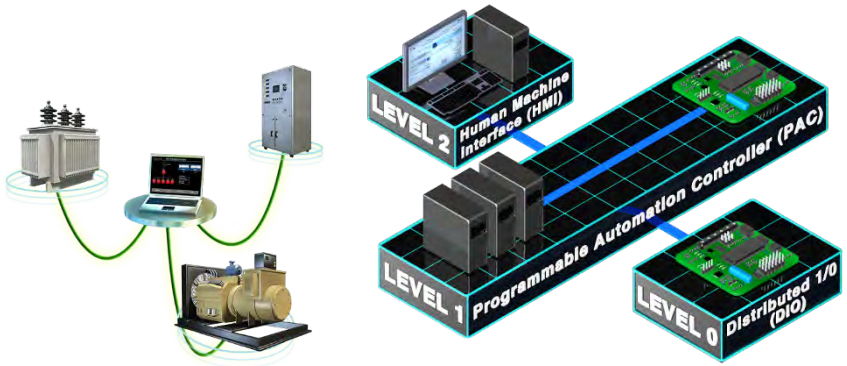
Exercise Goals – Learning Opportunities

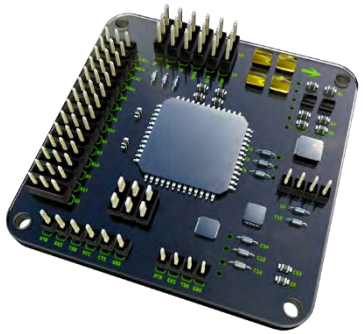


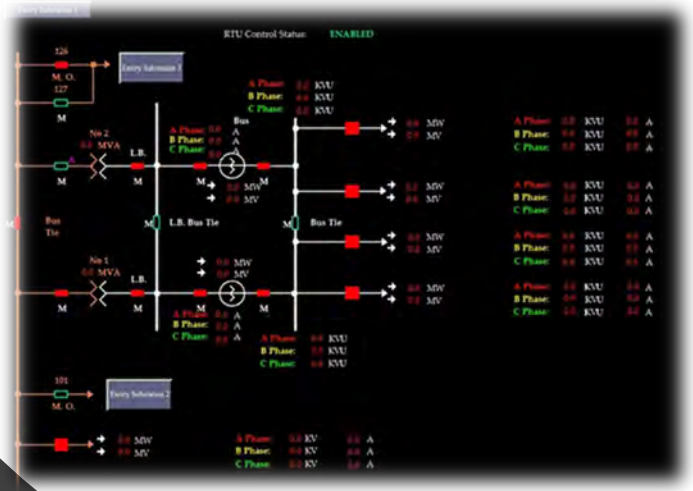
- ❑ Interaction and exposure to areas of your organization
- ❑ Interaction and exposure to peers
- ❑ Education on other sectors
- ❑ Learn from others experiences and challenges
- ❑ Identify need for response tools and technology

Operational Environment Silos







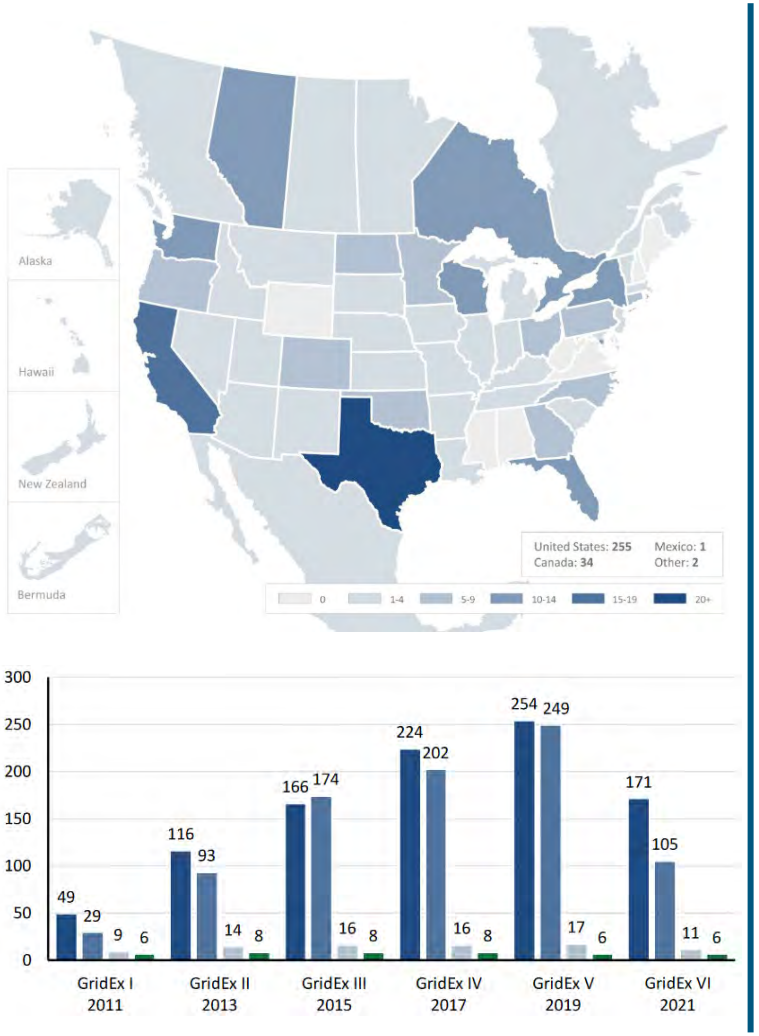

RTU Control Status: ENABLED
L.B.
L.B. Bus Tie
Bus Tie

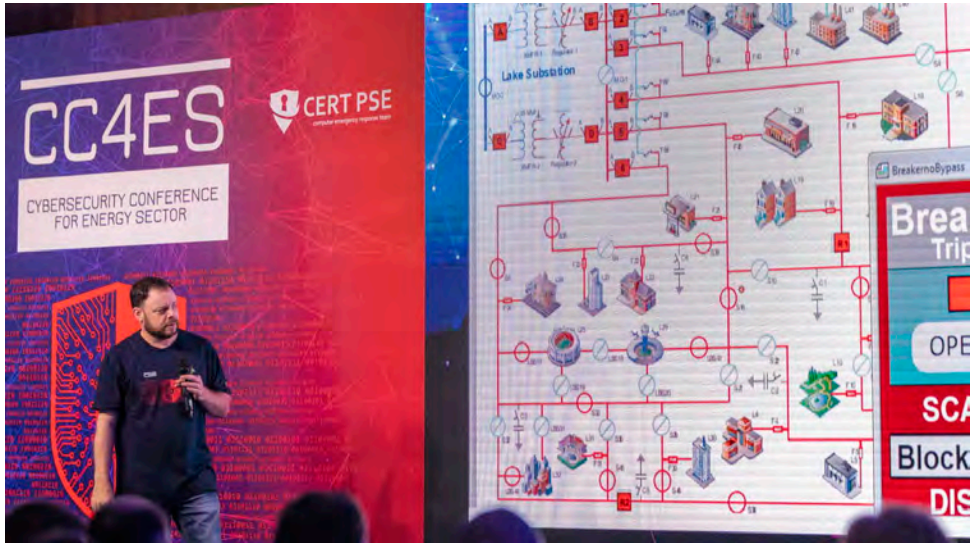

Main Substation Overview
230RCE


HACK3D


GRID
NETWARS

Exercises and Ranges





Команди BITI взяли участь у кібернавчаннях Grid NetWars

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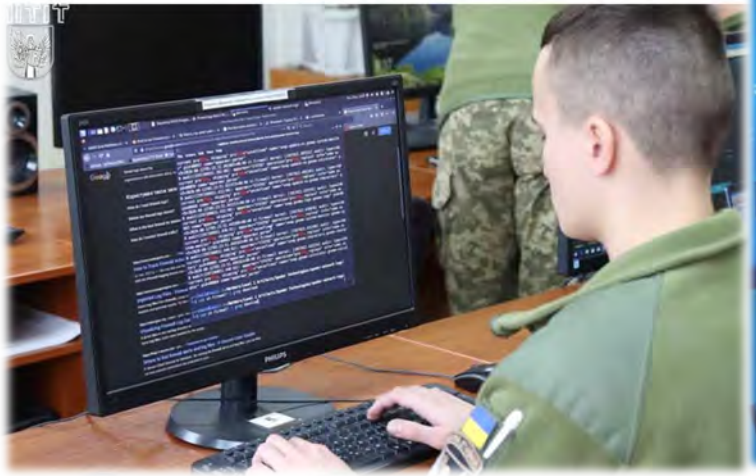
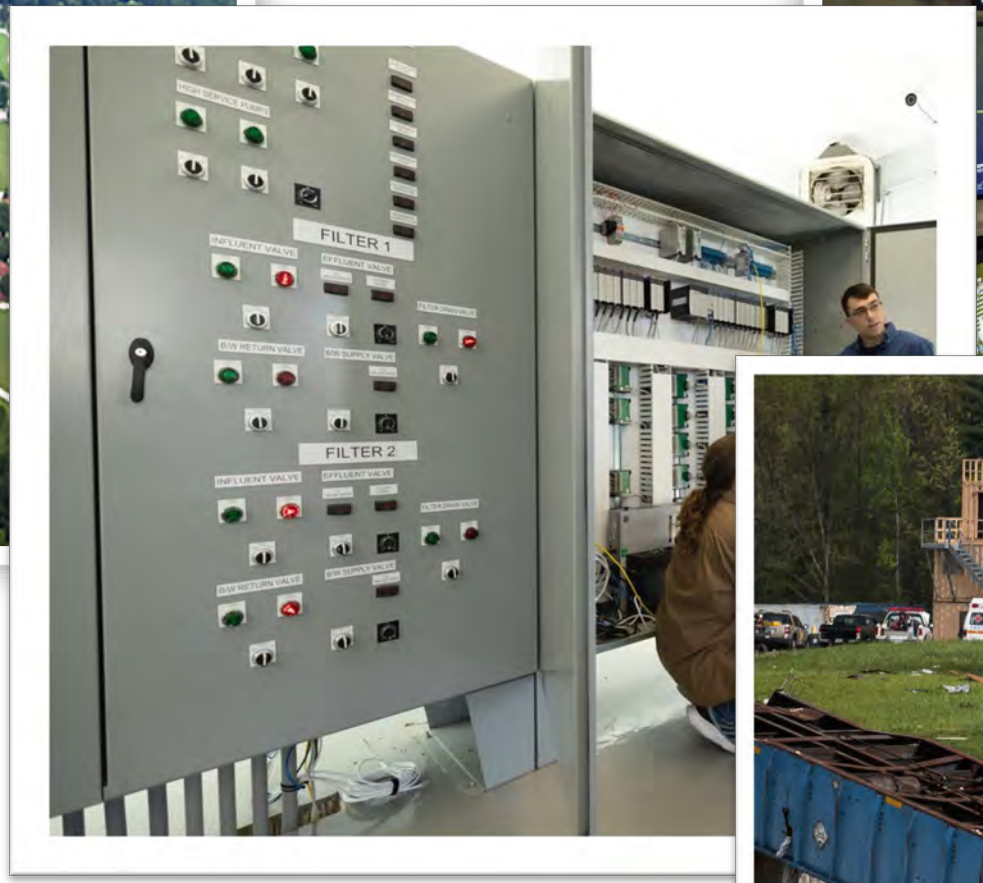


Hands on Elements

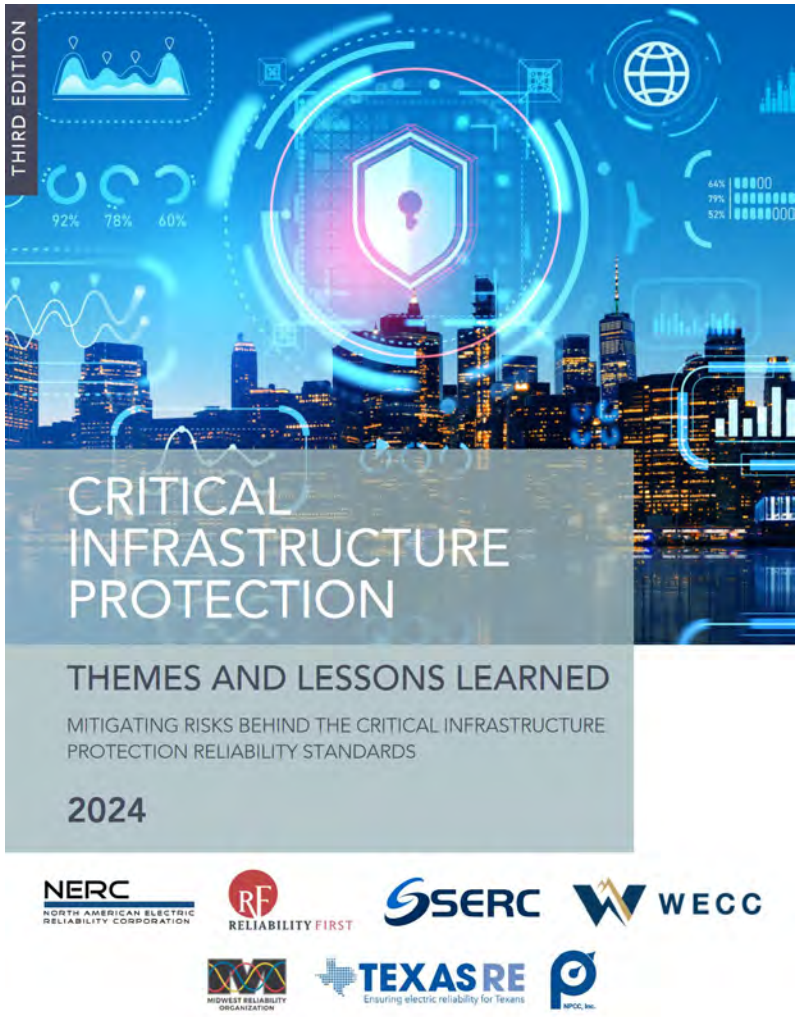
Muscatatuck Urban Training Center

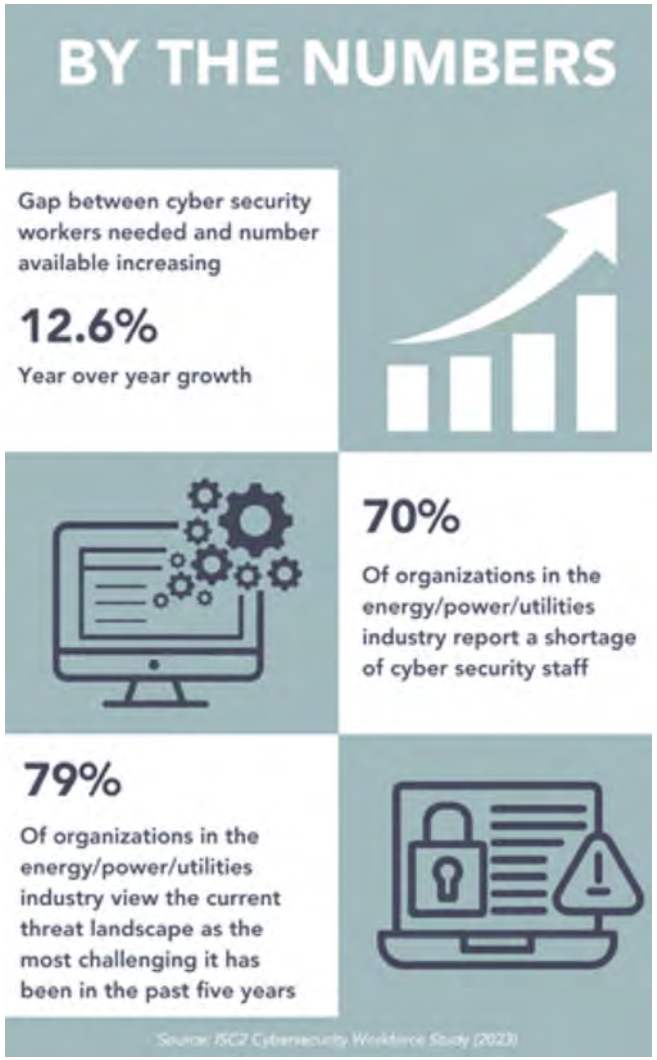


Parting Thoughts

NERC, DOE, & FERC

Theme 3 - Shortages of Labor and Skillsets





"The ERO Enterprise often sees noncompliances that result, at least in part, from entities losing skilled labor and failing to successfully transition the underlying job responsibilities to new or existing staff."

NERC Recommendations

- Utilize existing staff to train and develop others
- Work with HR to reassess competitive salaries to attract and retain
- Ensure adequate resources to execute processes without overly tasking existing staff
- For new technology pursue vendor training prior to implementation
- Implement succession plans for staff who support unique program components
- Identify technology commonalities between departments, BUs, or affiliates
- Leverage ERO provided: training, workshops, webinars, lessons learned resources

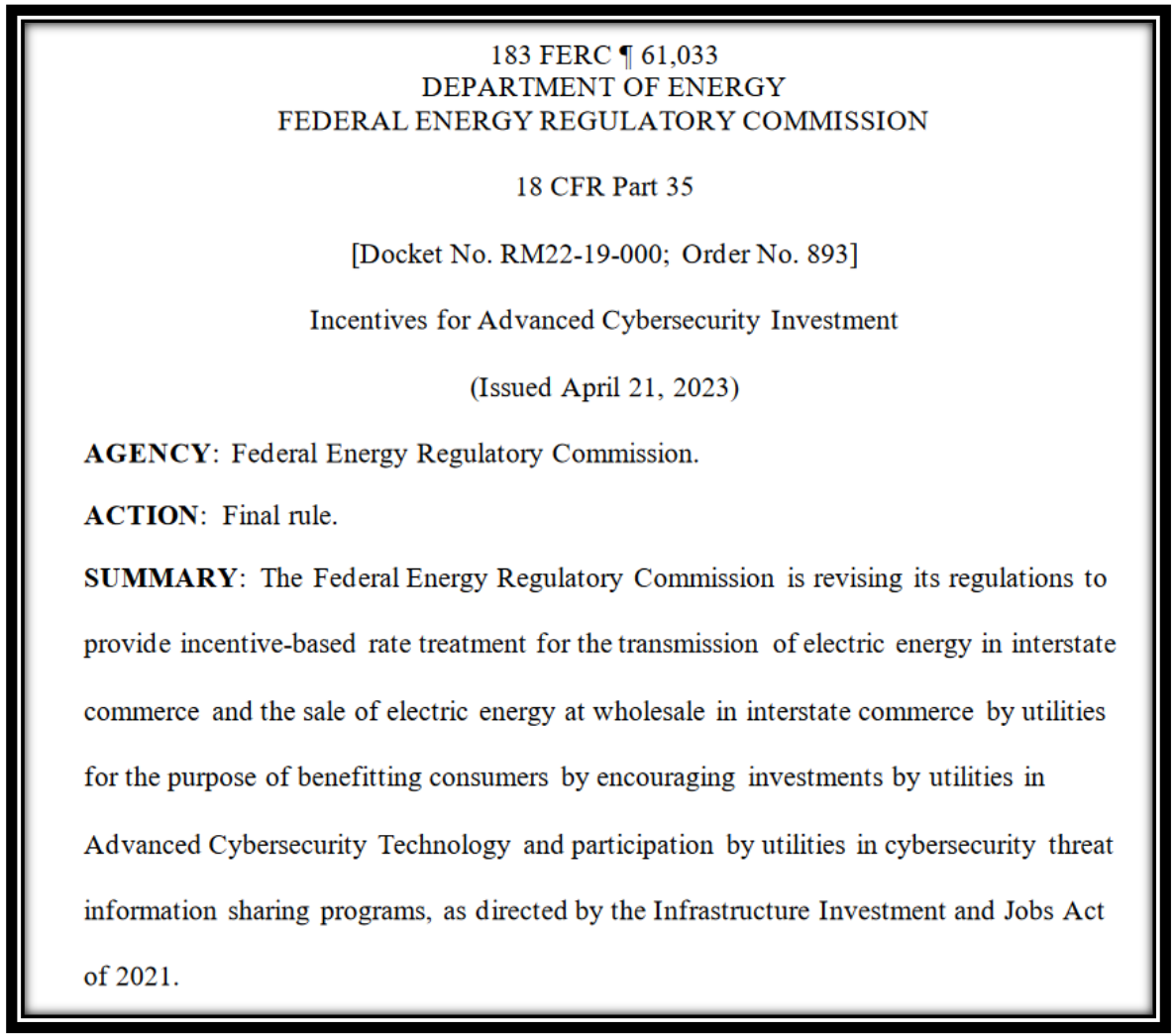
C2M2 WORKFORCE Domain – Workforce Management

The Workforce Management (WORKFORCE) domain comprises five objectives:

1. Assign Cybersecurity Responsibilities
2. Develop Cybersecurity Workforce
3. Implement Workforce Controls
4. Increase Cybersecurity Awareness
5. Management Activities

- Cybersecurity responsibilities are assigned to specific people
- **Cybersecurity training is provided as a prerequisite to granting access to assets that support the delivery of the function**
- Vetting is performed for all positions (including employees, vendors, and contractors) at a level commensurate with position risk
- **Adequate resources (people, funding, and tools) are provided to support activities in the WORKFORCE domain**
- The effectiveness of activities in the WORKFORCE domain is evaluated and tracked

FERC Order 893



183 FERC ¶ 61,033
DEPARTMENT OF ENERGY
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 35

[Docket No. RM22-19-000; Order No. 893]

Incentives for Advanced Cybersecurity Investment

(Issued April 21, 2023)

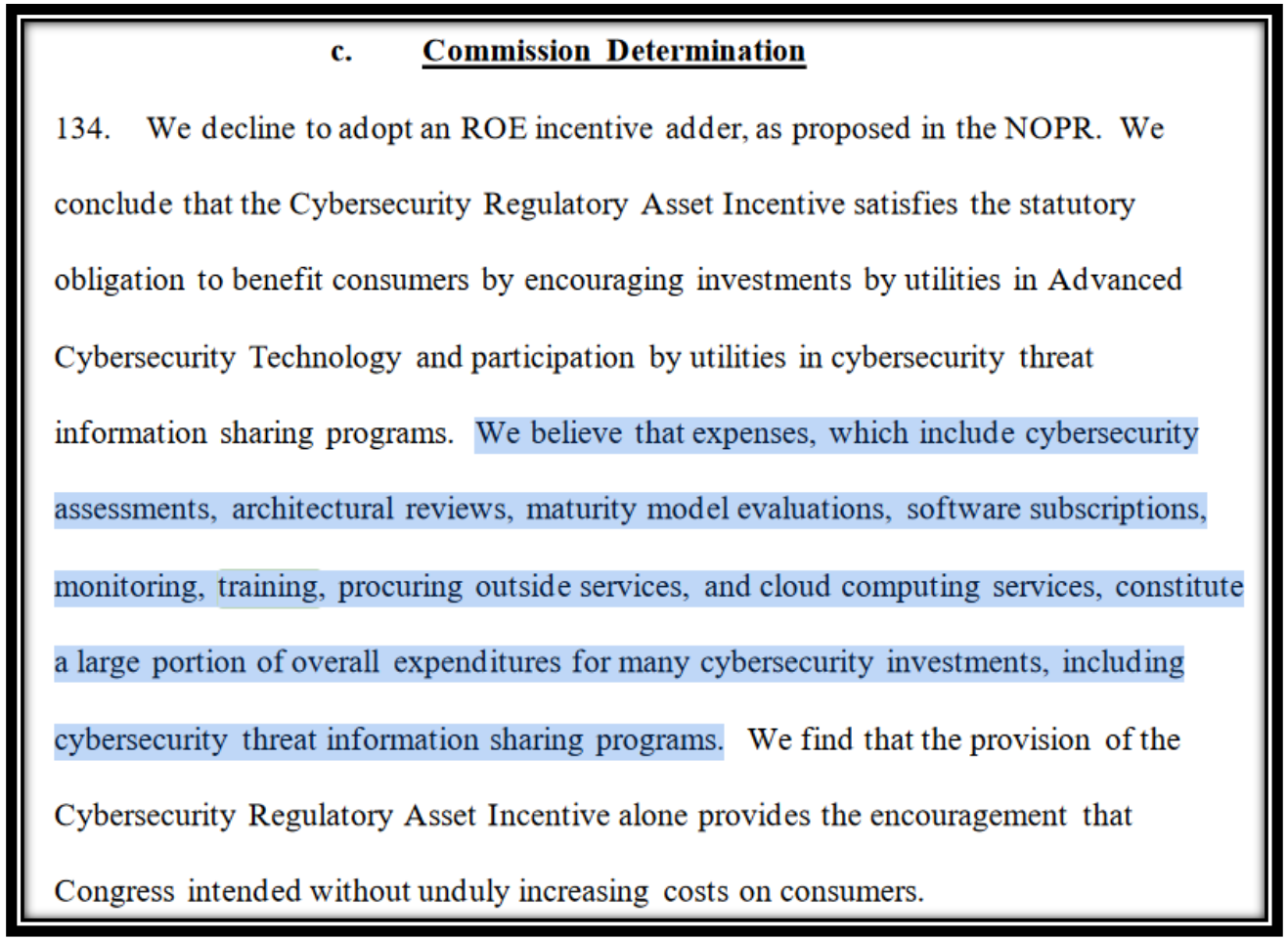
AGENCY: Federal Energy Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Federal Energy Regulatory Commission is revising its regulations to provide incentive-based rate treatment for the transmission of electric energy in interstate commerce and the sale of electric energy at wholesale in interstate commerce by utilities for the purpose of benefitting consumers by encouraging investments by utilities in Advanced Cybersecurity Technology and participation by utilities in cybersecurity threat information sharing programs, as directed by the Infrastructure Investment and Jobs Act of 2021.

Establishing incentive-based rate treatments for utilities' investment in advanced cybersecurity technologies and participation in cybersecurity threat information sharing programs. FERC issued Order No. 893

Training Callouts



c. **Commission Determination**

134. We decline to adopt an ROE incentive adder, as proposed in the NOPR. We conclude that the Cybersecurity Regulatory Asset Incentive satisfies the statutory obligation to benefit consumers by encouraging investments by utilities in Advanced Cybersecurity Technology and participation by utilities in cybersecurity threat information sharing programs. We believe that expenses, which include cybersecurity assessments, architectural reviews, maturity model evaluations, software subscriptions, monitoring, training, procuring outside services, and cloud computing services, constitute a large portion of overall expenditures for many cybersecurity investments, including cybersecurity threat information sharing programs. We find that the provision of the Cybersecurity Regulatory Asset Incentive alone provides the encouragement that Congress intended without unduly increasing costs on consumers.

Eligible expenses under this incentive include Capital expenses, and operation and maintenance expenses, outside services, implementation costs, network monitoring, training costs, and cloud computing expenses.

Training Callouts (2)

136. The Commission observed that a range of implementation costs associated with cybersecurity investments could be eligible for deferred rate treatment.[258] Such costs may include, for example, training to implement new cybersecurity practices and systems. However, the Commission proposed that, to be eligible for the incentive of deferred cost recovery, such training costs must be distinct from costs associated with pre-existing training on cybersecurity practices. The Commission stated that another

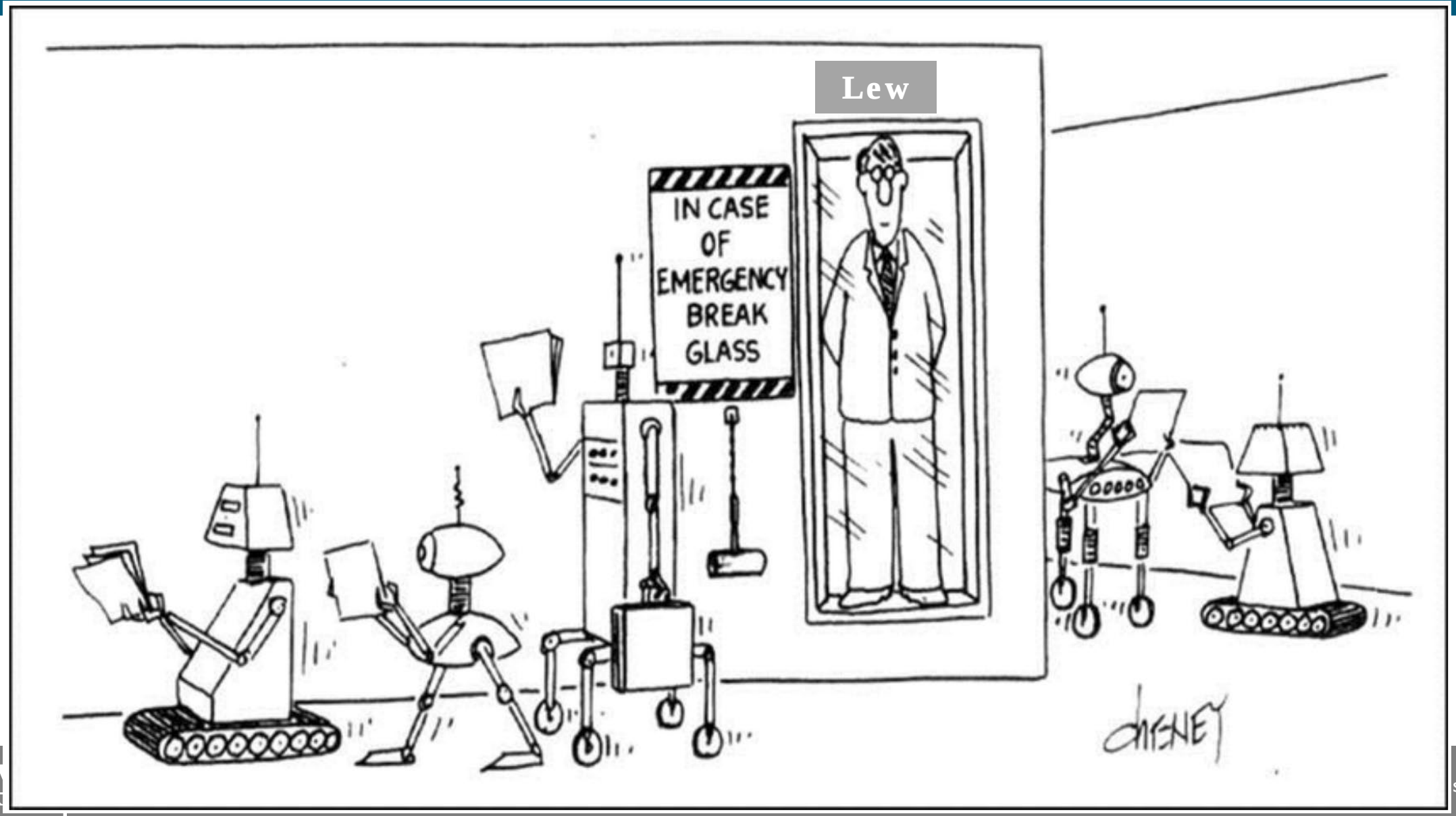
capitalized can be considered for deferral as a regulatory asset. Recurring costs may be eligible for deferral as a regulatory asset and may include, for example, subscriptions, service agreements, and post-implementation training costs. Specifically, the

- Mandatory training is not eligible
- Pre-existing training would not be eligible
- Training to implement new cybersecurity practices and systems
- Recurring costs for post-implementation training

SANS Free

Over 150 free tools, webinars, summits, CTFs, whitepapers, posters, cheat sheets, training, etc.
https://www.sans.org/security-resources/

Workforce of the Future – Over Reliance on the Machines



tconway@sans.org

FORWARD TOGETHER RELIABILITYFIRST

WHAT KEEPS A CSO UP AT NIGHT

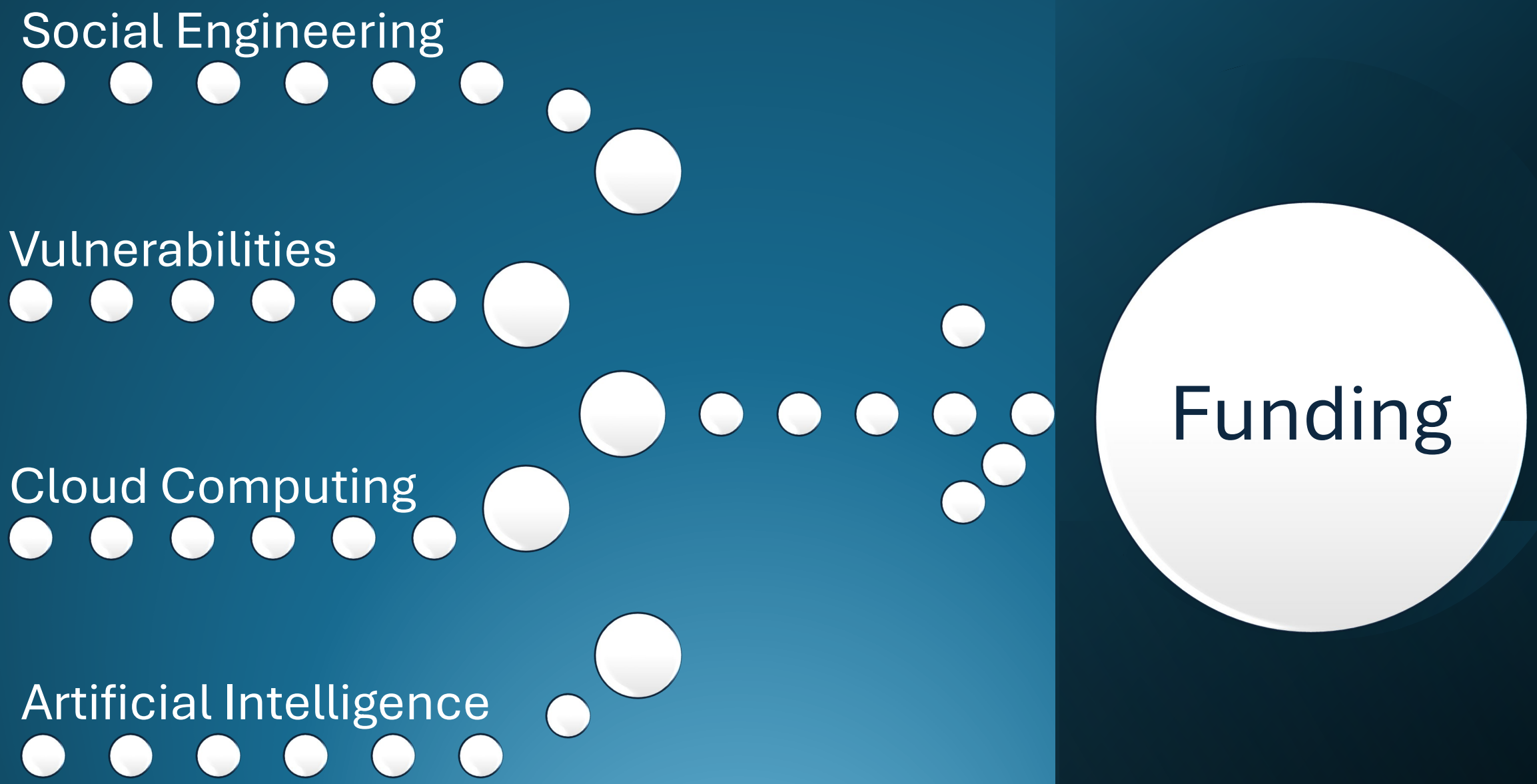
FELEK ABBAS

Vice President and Chief Security Officer, SPP

SPP Southwest Power Pool

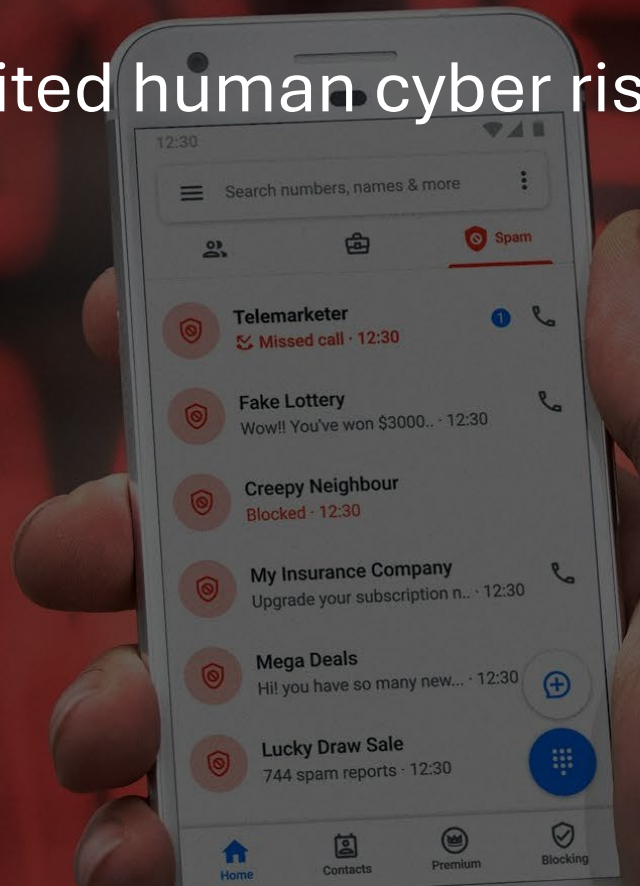
What Keeps a CSO up at Night?

RF FALL RELIABILITY SECURITY SUMMIT
SEPTEMBER 17, 2024
Felek Abbas


Social Engineering
Vulnerabilities
Cloud Computing
Artificial Intelligence
Funding

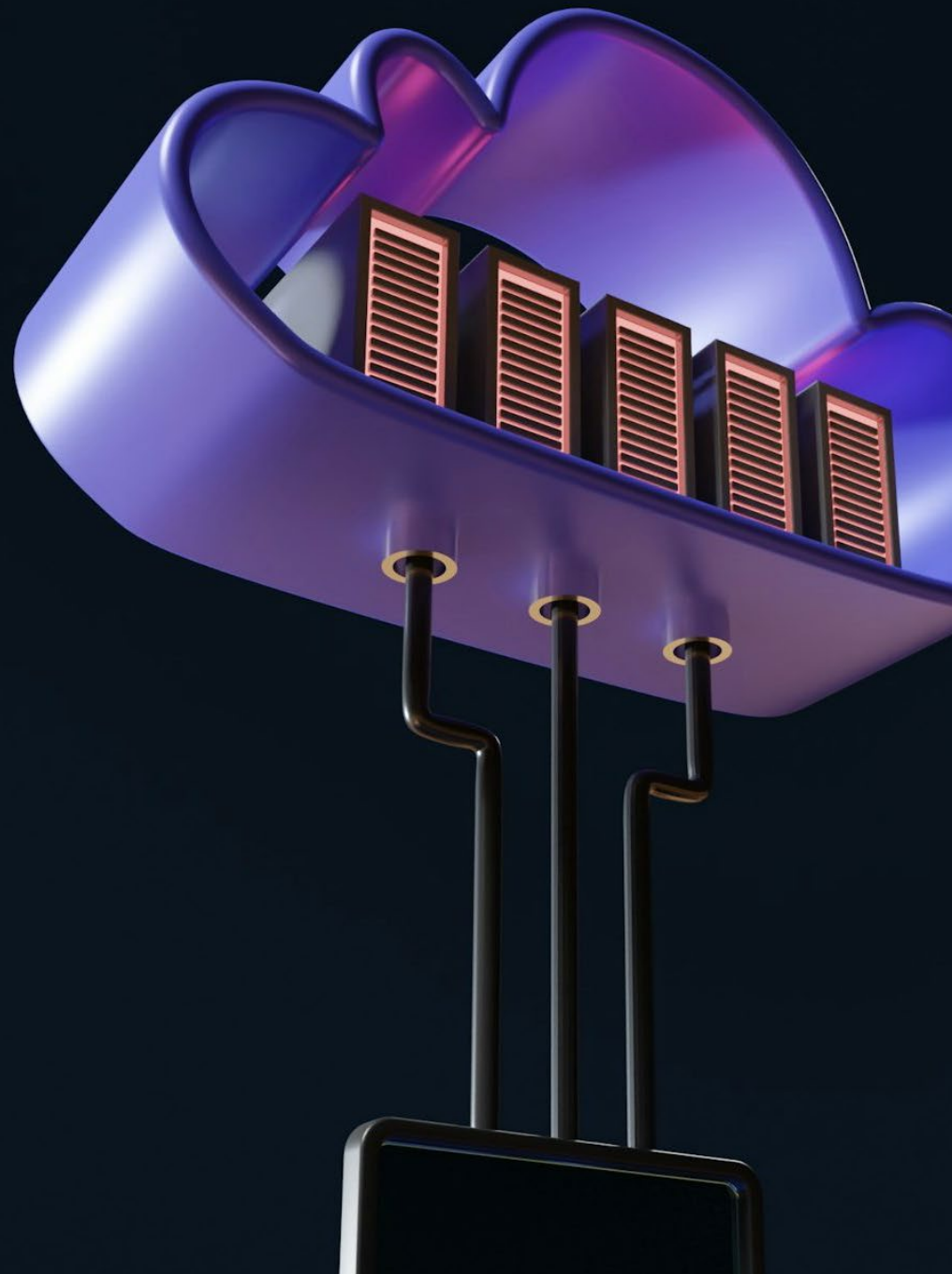
SOCIAL ENGINEERING

- According to SANS survey, this is the top cited human cyber risk
- Preparation
  - Extensive personnel training
  - Rigorous, continual testing
  - Reinforcement
  - Consequences



CLOUD COMPUTING

- Measured approach to cloud
  - What should go in the cloud?
  - Third-party risks
    - Compromises
    - Disruptions
    - Insider threats
  - Ongoing cloud cost (O&M)
  - Cloud exit strategy
    - Cost of repatriating



ARTIFICIAL INTELLIGENCE

- A lot of promise
  - LLMs for complex, dense information processing
  - Simulations and grid planning/management
- Data leakage
- Similar cloud use risks
- Potential for on-prem use

Explosion of Vulnerabilities

- The rate of vulnerability discovery is growing
- The ability of organizations to manage the growth is not scaling
- Looking for more efficiencies to shorten the discovery to mitigation window
  - Automation
  - AI

FUNDING

- For utilities, and most organizations, cybersecurity is a necessary cost
- Limited funds are available for most, if not all, organizations tackling threats
- As the critical infrastructure of critical infrastructures, we, as a nation, need to allocate adequate resources to protect the grid
- FERC Order 893
- What about the ISO/RTOs, rural cooperatives, municipalities?
    - We share a joint destiny as interconnected entities on the grid

SOCIOECONOMIC CONSIDERATIONS FOR THE ELECTRIC GRID

JEROME DUMORTIER

Professor and Director of Research, School of Public and Environmental Affairs, Indiana University Indianapolis

INDIANA UNIVERSITY INDIANAPOLIS

Socioeconomic Considerations for the Electric Grid

Impact of Decarbonization Efforts and Climate Change on Electricity Markets and Agricultural Land-Use

Jerome Dumortier

17 September 2024

ReliabilityFirst (RF) Fall Reliability and Security Summit, Indianapolis, Indiana

Introduction

Short biography

- Ph.D. in Economics from Iowa State University in 2011
- Faculty member at Indiana University Indianapolis since 2011

Research

- Research on agriculture, land-use, and bioenergy since 2009
- Transition of research towards energy more broadly due to interactions between land-use and economy-wide decarbonization efforts
  - Light-duty vehicle electrification and possibility of bio-based diesel for the freight sector
  - Sustainable aviation fuels (SAF)
  - Land requirements for solar and wind farms
- Forward-looking research to inform stakeholders about the impact of future macroeconomic trends, policies, and climate change

Presentation Overview

Past and future evolution of temperature

- Climate modeling and future climate trajectories
- Focus on temperature (as opposed to precipitation) due to its importance for electricity demand

Decarbonization of the transport sector

- Electric vehicles (including Advanced Clean Cars II regulation)
- Sustainable Aviation Fuels (SAF)

Relationship between transport decarbonization and land-use

- Crop yield modeling under climate change
- Land-use effects of climate change and climate change policy
- Impacts on land returns

Short Newspaper Article

"The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries."

Rodney and Otamatea Times, Waitemata and Kaipara Gazette, 4 August 1912, Page 7

Global Surface Air Temperature Anomaly

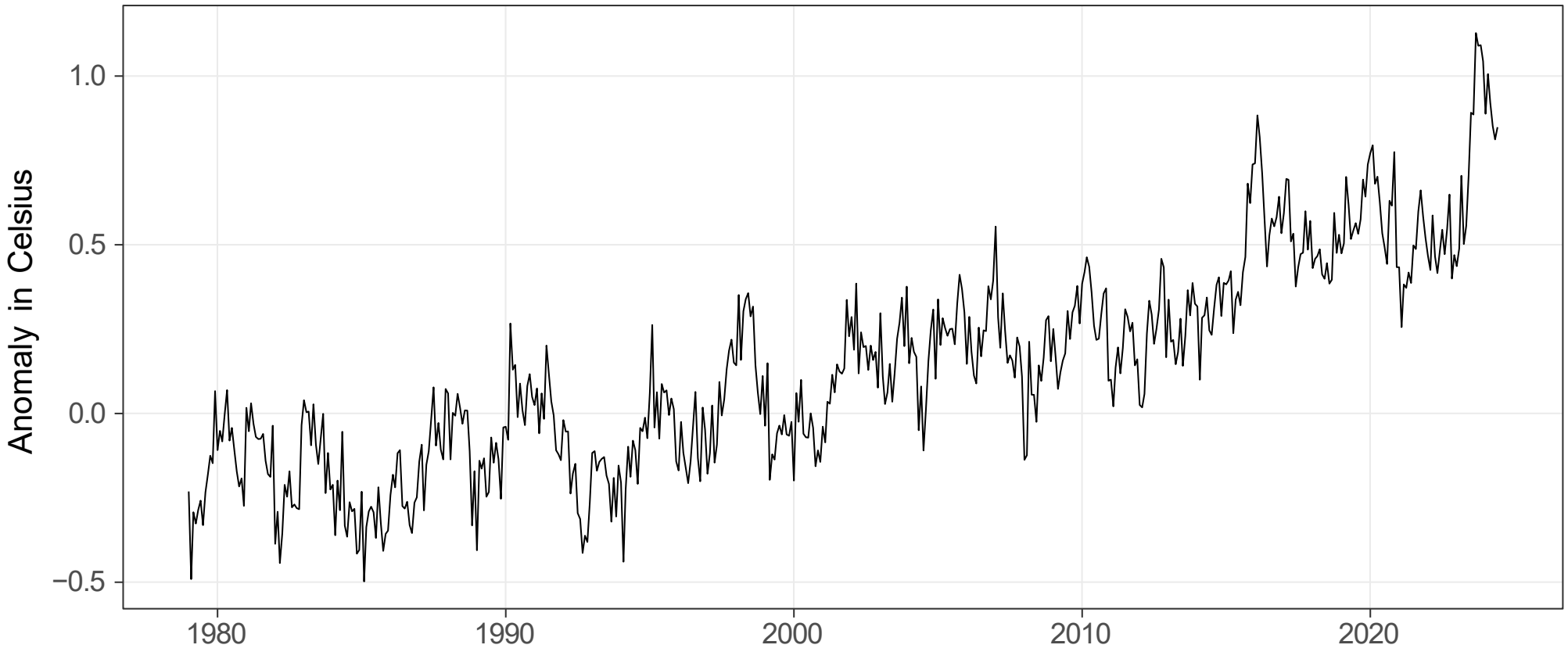


Figure. Global temperature anomaly (January 1979 to June 2024) compared to 1981–2010 mean. Source: EU Copernicus Programme

Temperature Change for RF Region

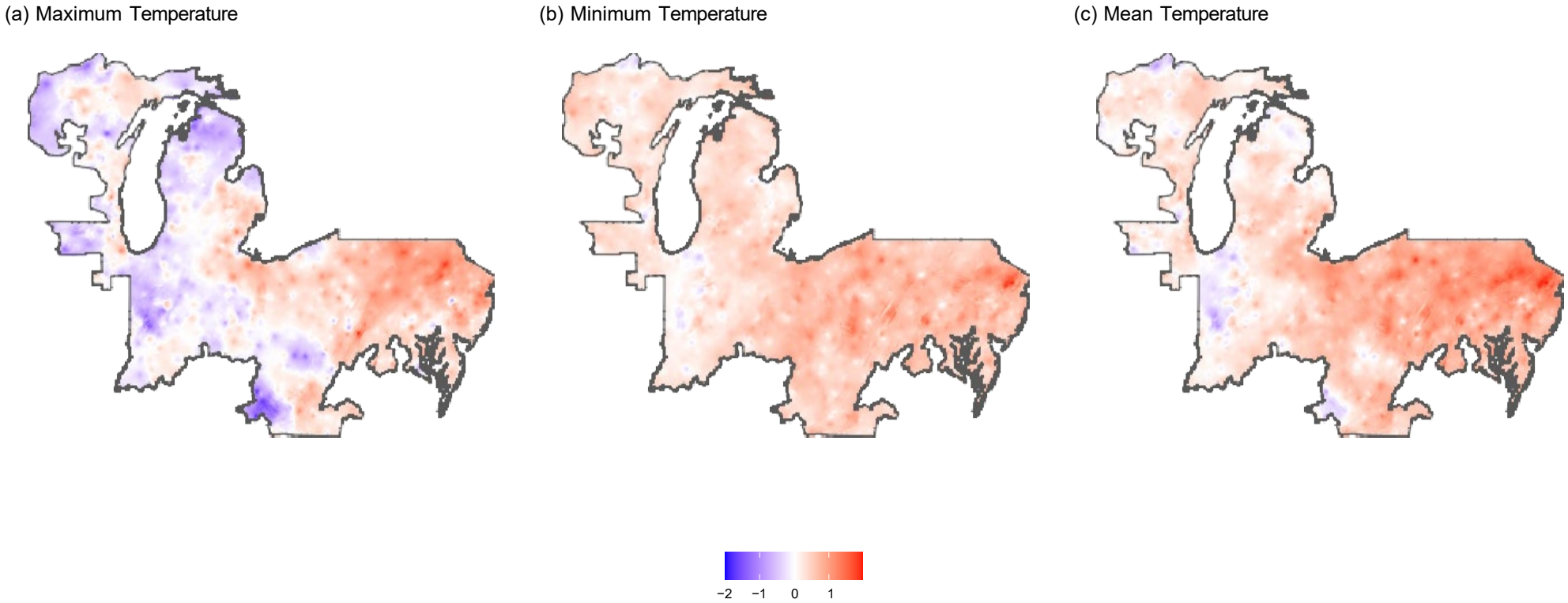


Figure. Change in mean July temperature (in Celsius) between 1981–1990 and 2011–2020. Data Source: PRISM Climate Group at Oregon State University

Future Climate Modeling

Representative Concentration Pathways (RCP)

- Scenarios representing different greenhouse gas (GHG) concentrations in the atmosphere
- Lower RCP values correspond to lower GHG emissions
- Common RCPs: RCP2.6, RCP4.5, RCP6.0 (current emission trend), and RCP8.5
- Input to climate models

Global Climate Models (GCM)

- Computer models to simulate the behavior of Earth's climate system
- Essential for understanding past climate variability, projecting future climate change, and assessing the impacts of various factors on the climate
- Climate change projections under different GHG emission scenarios

Change in Extreme Temperature Days

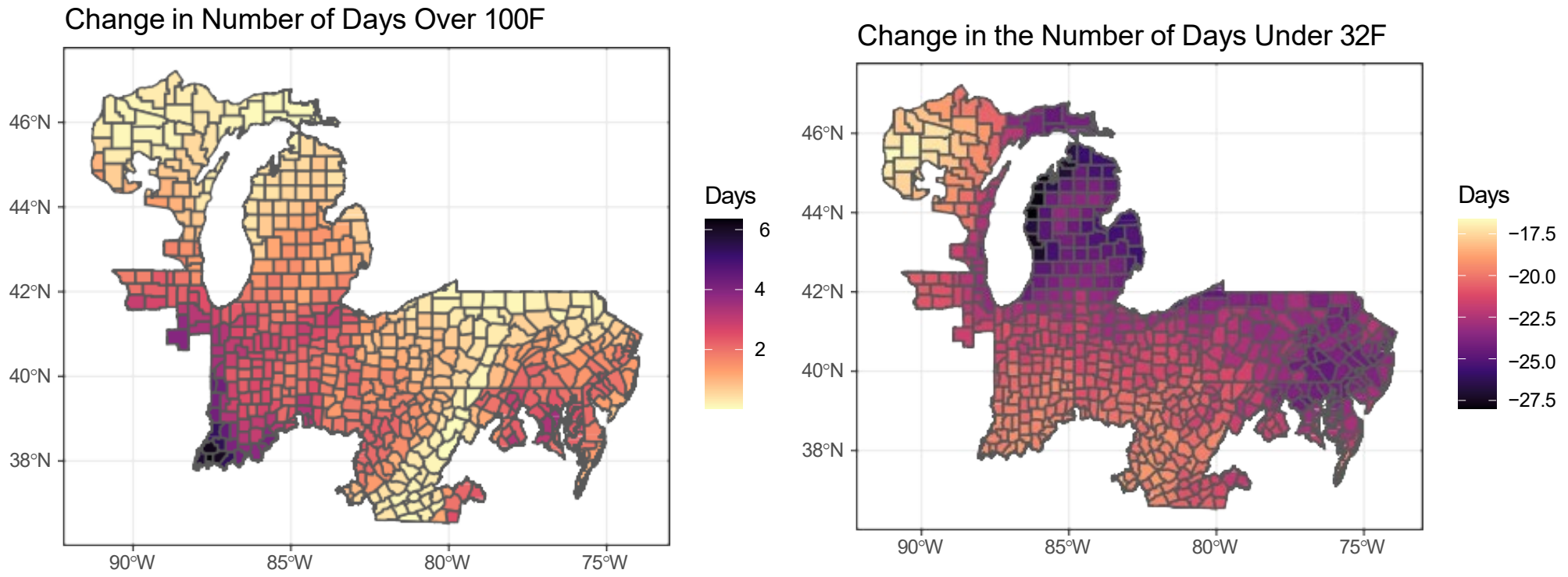


Figure. Change in extreme temperature days under an increase in global temperature by 2 degrees Celsius. Source: NCA 2023

Changes to Temperature in Marion County

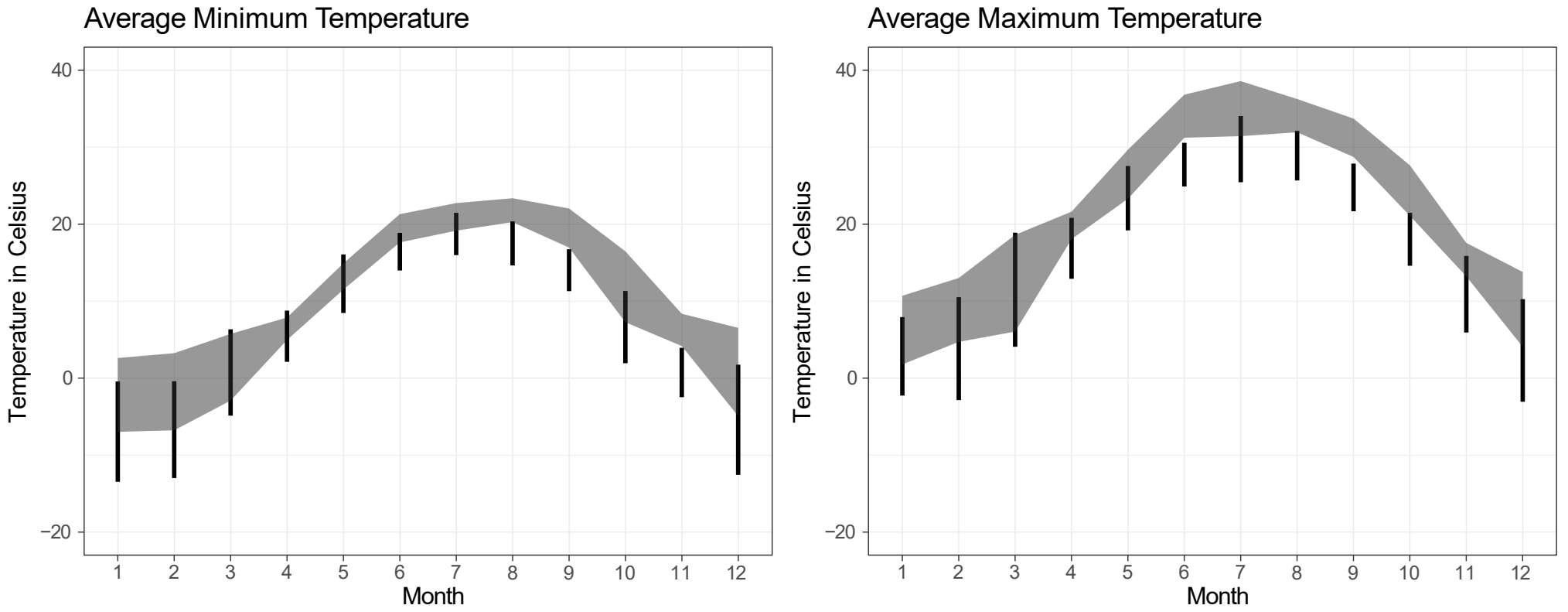


Figure. Solid bars: Average monthly minimum/maximum temperature range 1981–2023. Shaded area: Average monthly minimum/maximum temperature range 2050 under RCP8.5 based on global climate models: GFDL-ESM4, HadGEM3-GC31-LL, HadGEM3-GC31-MM, IPSL-CM6A-LR, MPI-ESM1-2-HR, MRI-ESM2-0, and UKESM1-0-LL.

Overview

Increase in ethanol use since mid-2000s

- Corn ethanol as a substitute for MTBE (Methyl-tert-butylether)
- Energy independence and greenhouse gas emissions
- Substitute in the production of gasoline due to high oil prices in 2008
- Consequences: About 1/3 of U.S. corn production for ethanol

Light-duty vehicle electrification

- Long-term decline of ethanol demand due to vehicle electrification
- Implications for farm and consumer welfare as well as land-use and land prices

Sustainable Aviation Fuels

- Multiple feedstocks (besides corn) including soybeans and forest residues

Importance of carbon intensity (CI) scoring for SAFs and (voluntary) carbon markets

Electric Vehicle Market Projections

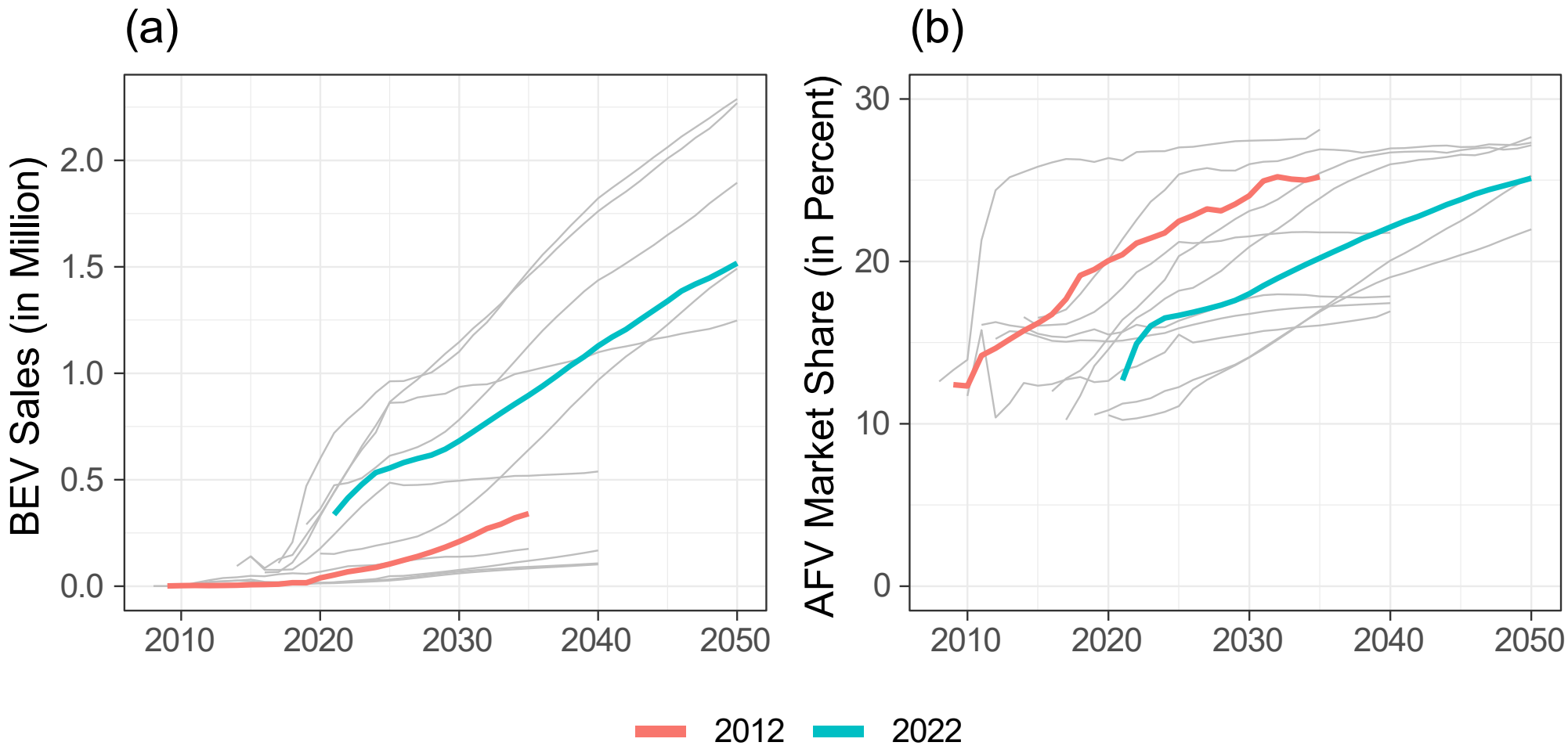


Figure. (a) Battery electric vehicle sales and (b) alternative fuel vehicle market share.
Source: 2012–2022 Annual Energy Outlook, U.S. Energy Information Administration

Ethanol Use

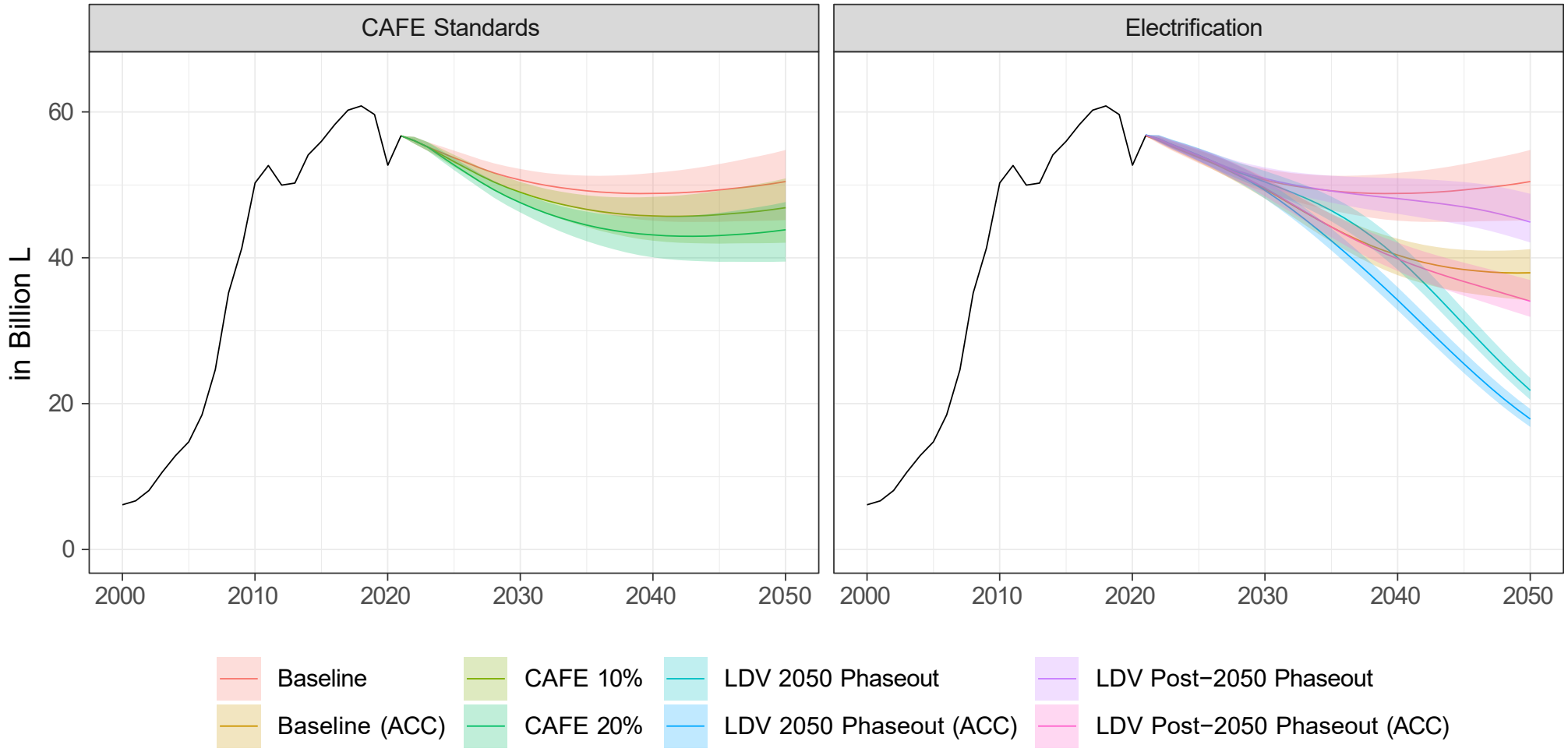


Figure. Historic and projected ethanol use under various Corporate Average Fuel Economy (CAFE) standards and vehicle electrification rates. Source: Dumortier (2024).

Difference in Area

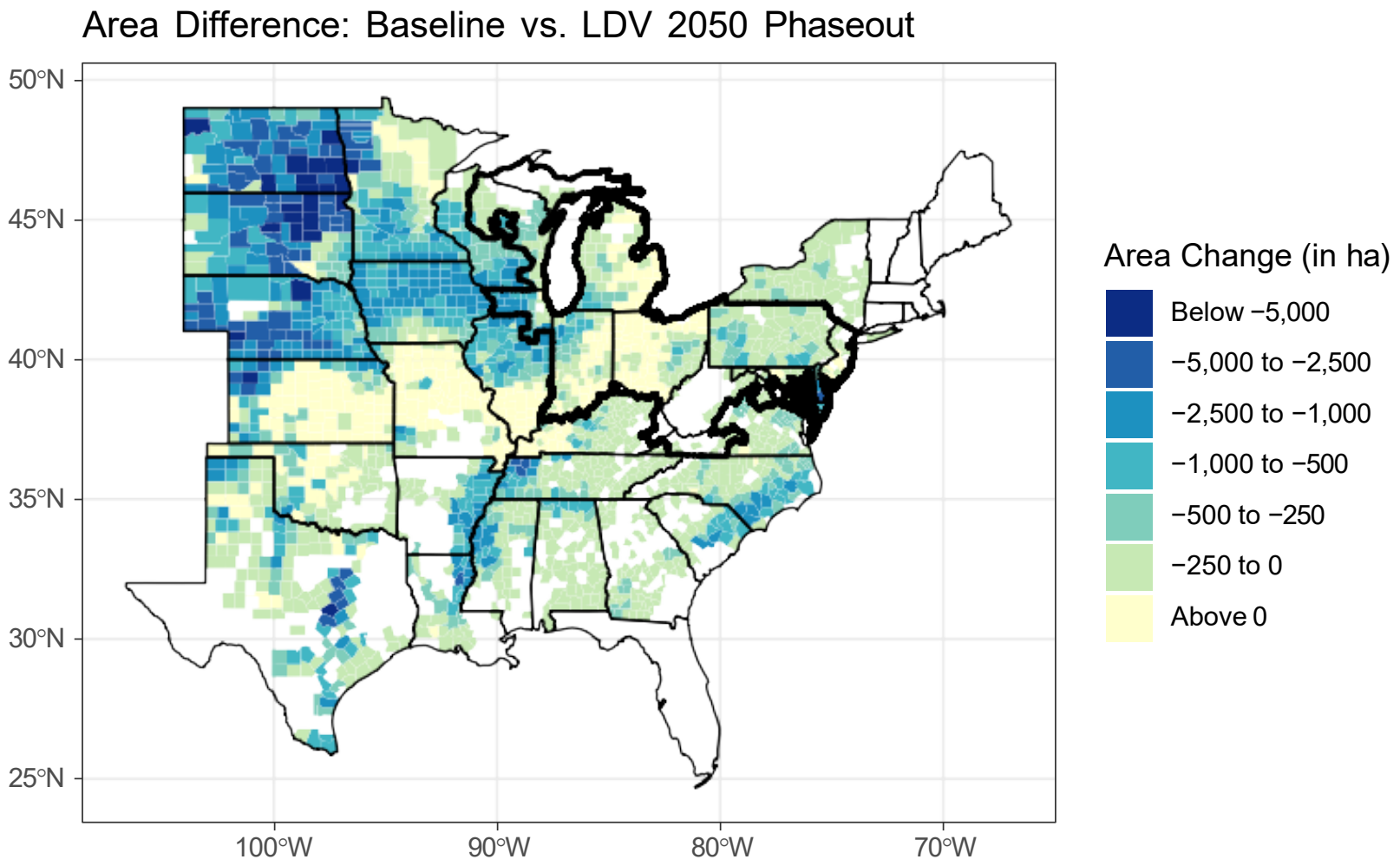


Figure. Difference in area allocation to six crops. Source: Dumortier (2024).

Difference in Profitability

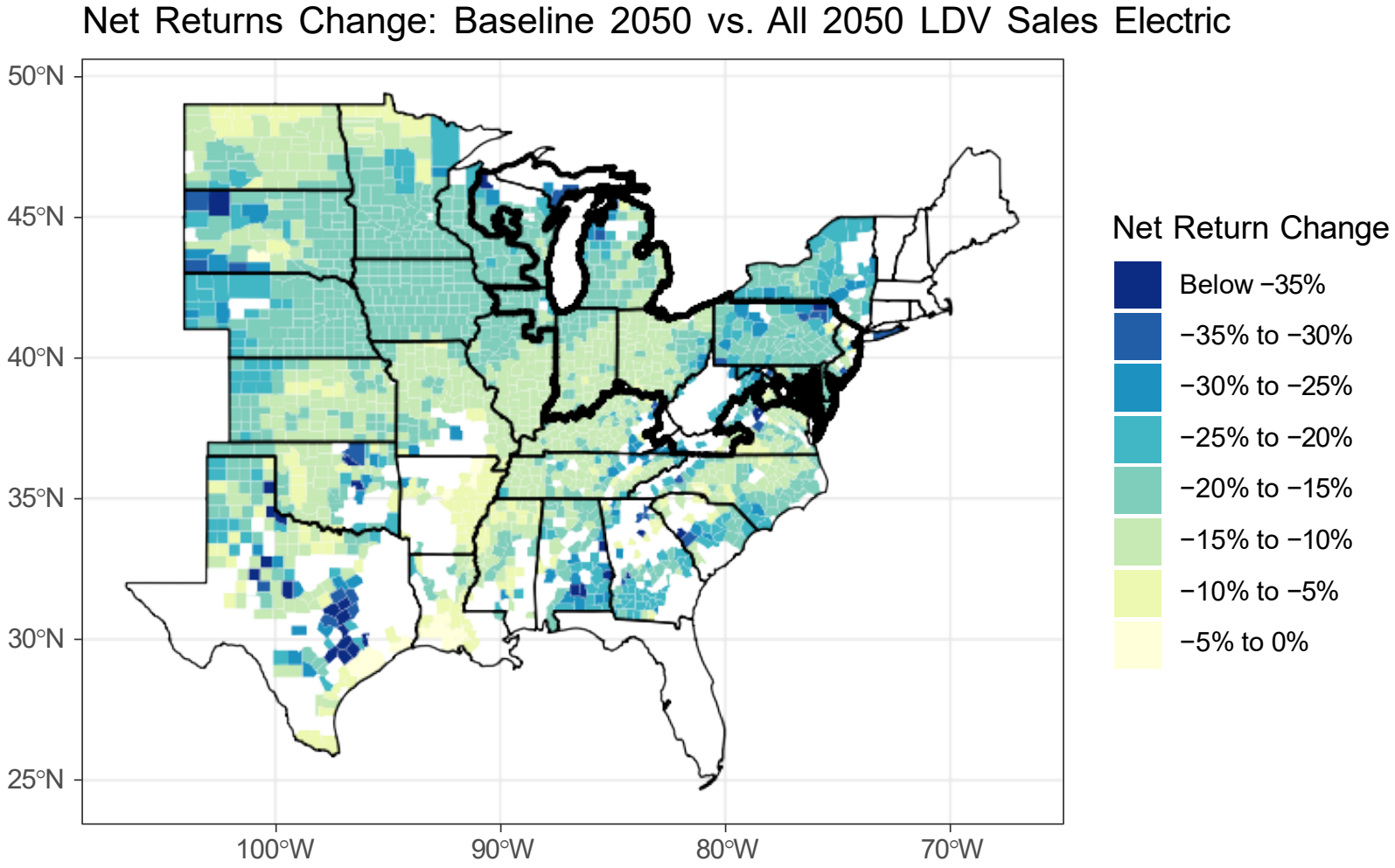


Figure. Difference in net returns from six crops. Source: Dumortier (2024).

Major Unknown Factors

Future rate of electric vehicle adoption

- Expansion of ACC II to potentially other states or drive of electric vehicles by manufacturers

Future of SAFs

- High barriers for corn to qualify for tax credits
- Corn requirements: Adoption of cover crops, no tillage, and enhanced efficiency nitrogen fertilizer
- Tax credits paid to SAF producer but requirements for farmers

Voluntary carbon markets

- Revenue from adoption certain carbon sequestering practices

Positive or negative impact of all unknown factors on land prices

Large-Scale Solar Photovoltaic Installations

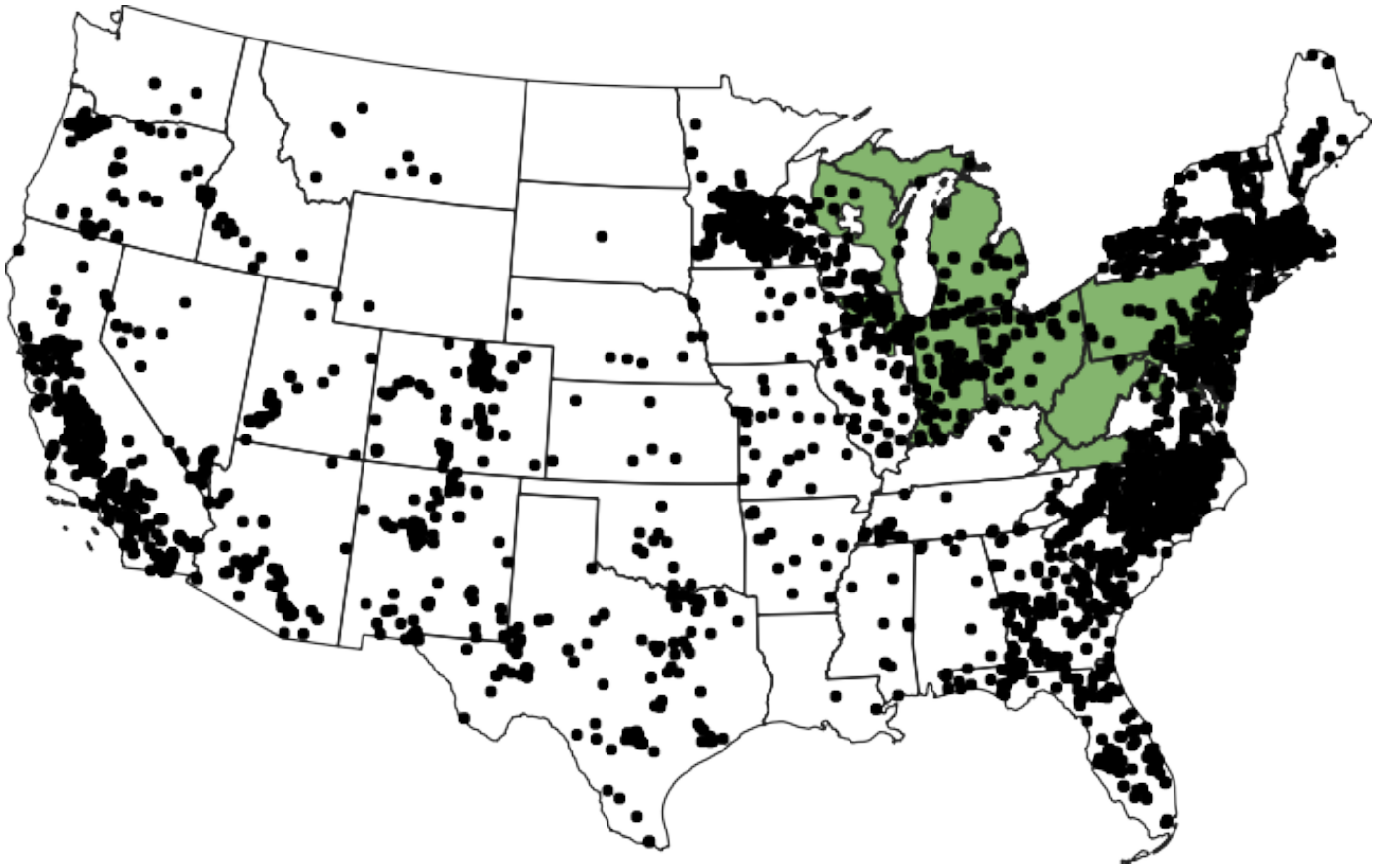


Figure. Current location of large-scale PV installations. Source: USGS Large-Scale Solar Photovoltaic Database.

Yield Changes

Modeling crop yields

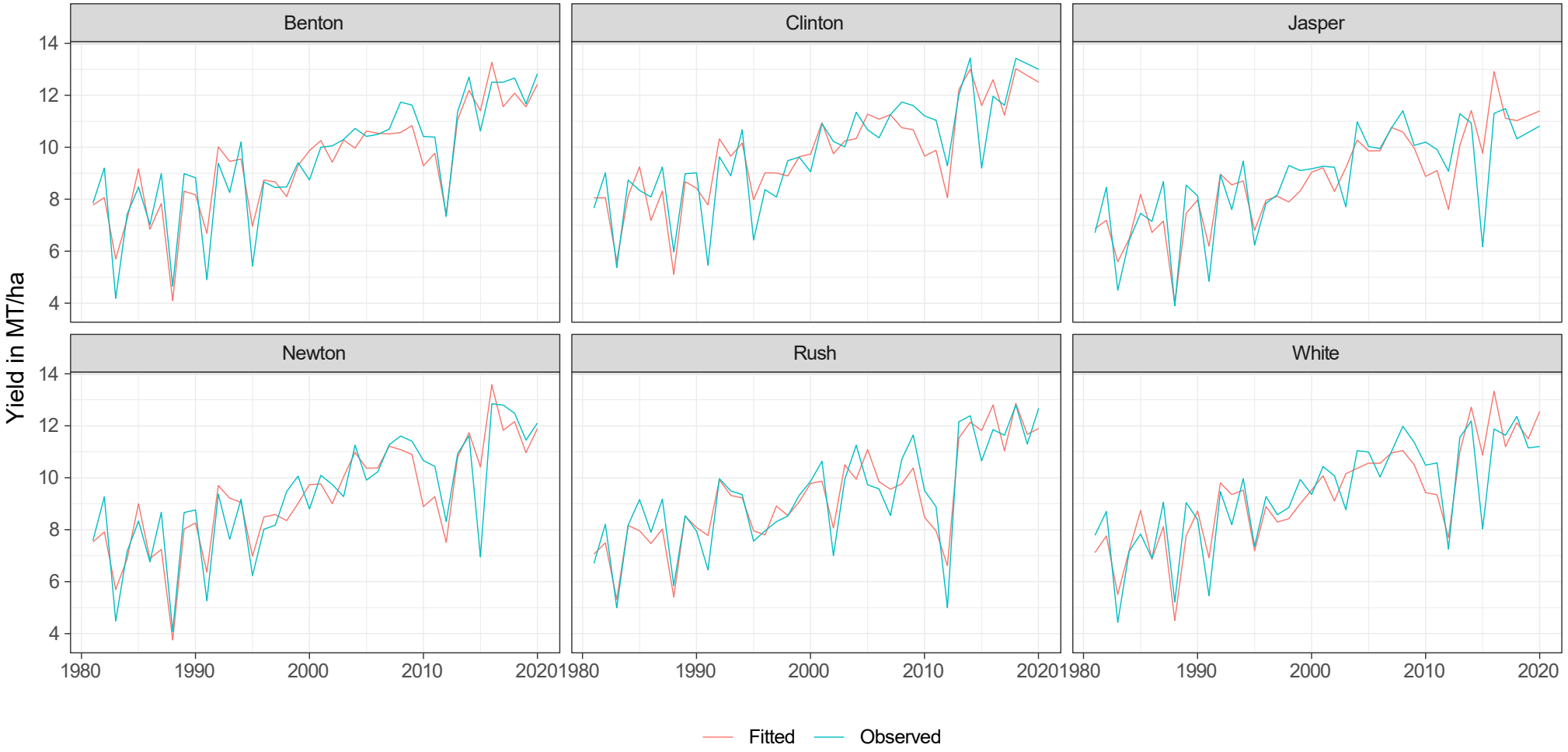
- Statistical models
- Process-based models

Commonly used variables influencing yield

- GDD: Growing degree days as a measure for favorable growing conditions
- HDD: High degree days as a measure for heat stress
- Precipitation as a measure for water availability

Similarity to electricity demand modeling

Corn Yield for Top Producing Counties in Indiana



Conclusion

Land as an asset playing an important role regarding climate change (policy)

- Revenue from energy production
  - Currently: Corn ethanol
  - Future: Potentially corn ethanol but also other feedstock for SAFs
  - Solar installations
- Revenue from carbon sequestration
  - Voluntary carbon markets
  - Feedstock producer for energy sector with carbon intensity scoring requirements

Potentially large impacts of climate change on yields reducing the supply of feedstock

MISO RELIABILITY IMPERATIVE

FORWARD TOGETHER RELIABILITYFIRST

TODD HILLMAN

Senior Vice President and Chief Customer Officer, MISO

MISO

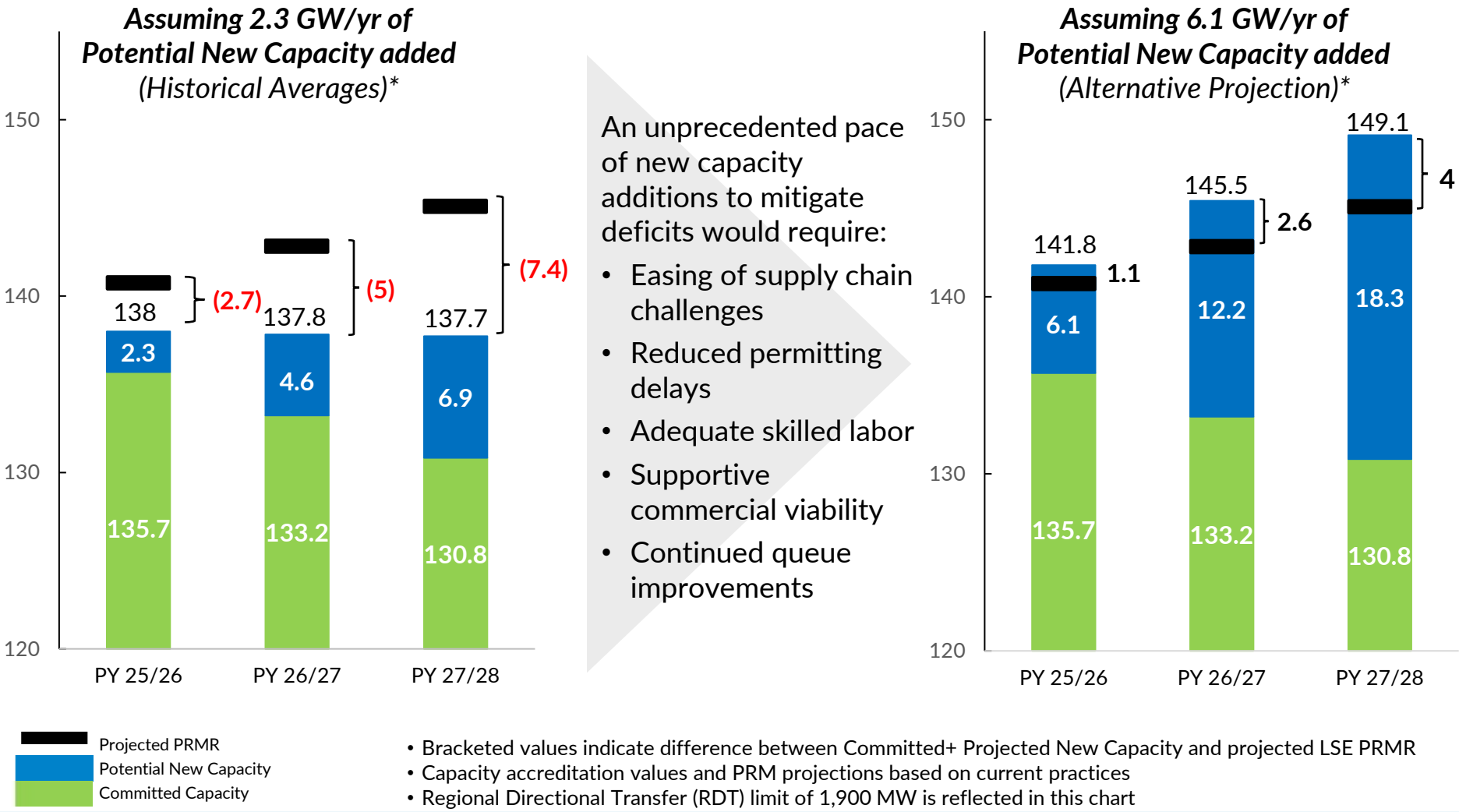
ReliabilityFirst Fall Reliability & Security Summit

MISO Reliability Imperative

September 17, 2024

2024 OMS-MISO Survey indicates increasing capacity deficits requiring a dramatically accelerated pace of new build to mitigate

OMS - MISO Survey Resource Adequacy Projections – Summer (Accredited GW)



- Bracketed values indicate difference between Committed+ Projected New Capacity and projected LSE PRMR
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1,900 MW is reflected in this chart

PRMR: Planning Reserve Margin Requirement *All references to capacity indicate Seasonal Accredited Capacity (SAC)*

** Using methods for Potential New Capacity described in 2024 OMS-MISO Survey presentation*

Capacity trends of our RTO neighbors point to declining availability of supportive transfers

PJM

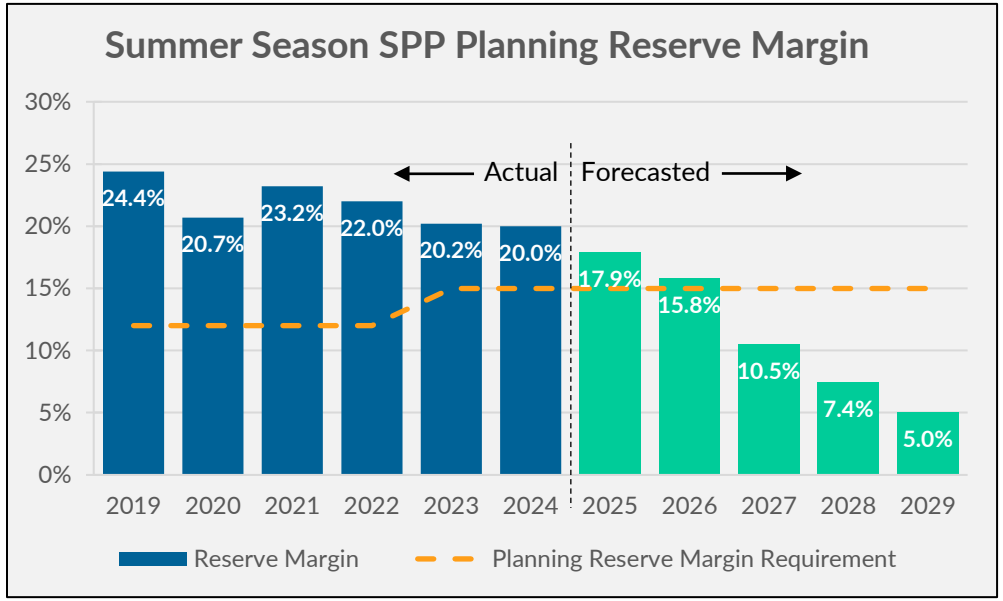
Significant year-over-year supply/demand changes resulted in record prices in capacity auction for 2025/26 delivery year

Offered Supply: GW	- 13.3	*(down 8.8% vs. prior year)*
Load:	+ 3.2 GW	*(up 2% vs. prior year)*
Reserve Margin: (% above target)	0.7 %	*(vs. 5.4% in prior year)*
Clearing Price:	~ $270 / MW-day	*(vs. ~$29 in prior year)*

Source: PJM 2025/2026 Base Residual Auction Report

SPP

No capacity auction but reserve margin projected to fall to requirement in 2026 and decline further



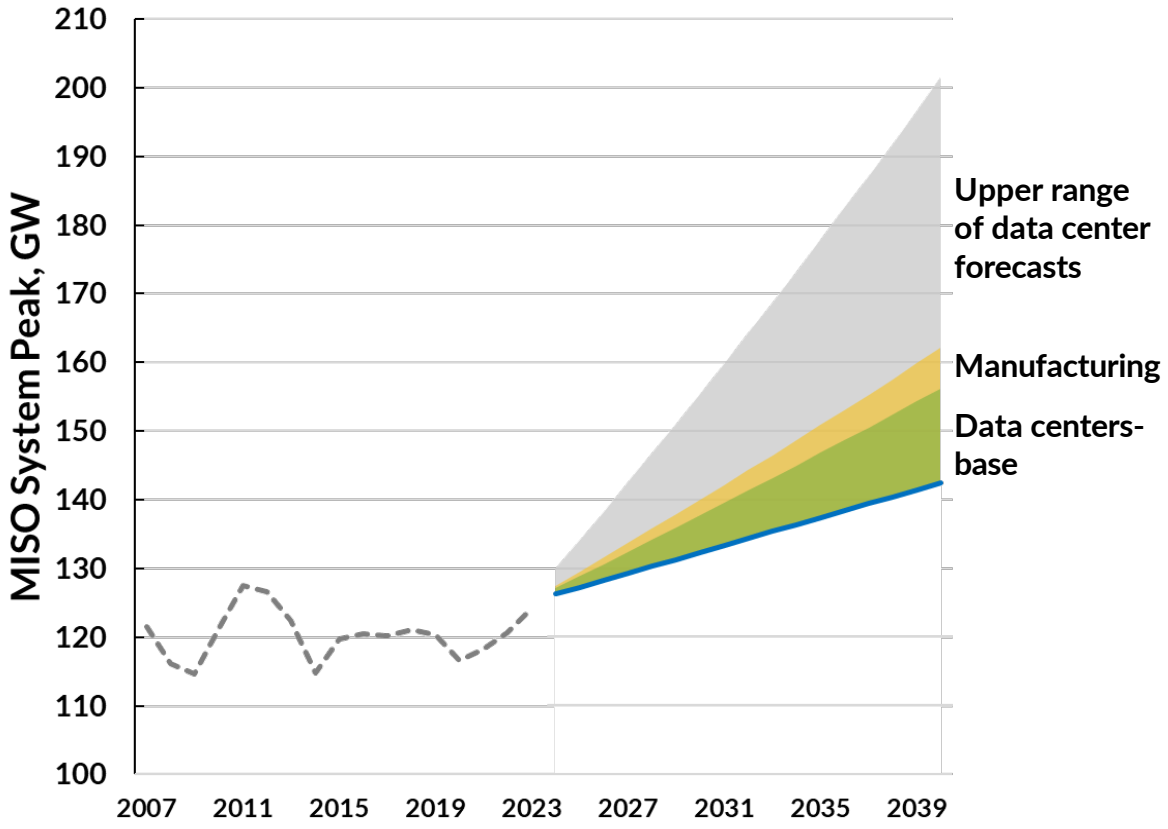
Excess capacity of 2,750 MW in 2024 becomes a deficit of 5,950 MW in 2029 due to:

- 10% increase in forecasted demand
- 3% reduction in capacity

Source: 2024 SPP Resource Adequacy Report

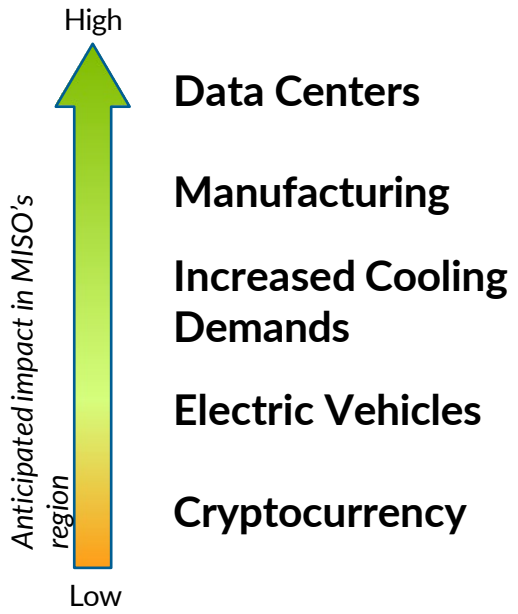
Poor visibility into the magnitude/timing of large load additions is putting at risk our ability to reliably accommodate them

EPRI and Grid Strategies[1] anticipate manufacturing growth to favor MISO's service area



***Notes:** All figures shown are PRELIMINARY*

- Grid planners nearly *doubled* their 5-year peak load growth forecasts since last year
- MISO anticipates strong *long-term* load growth driven primarily by:

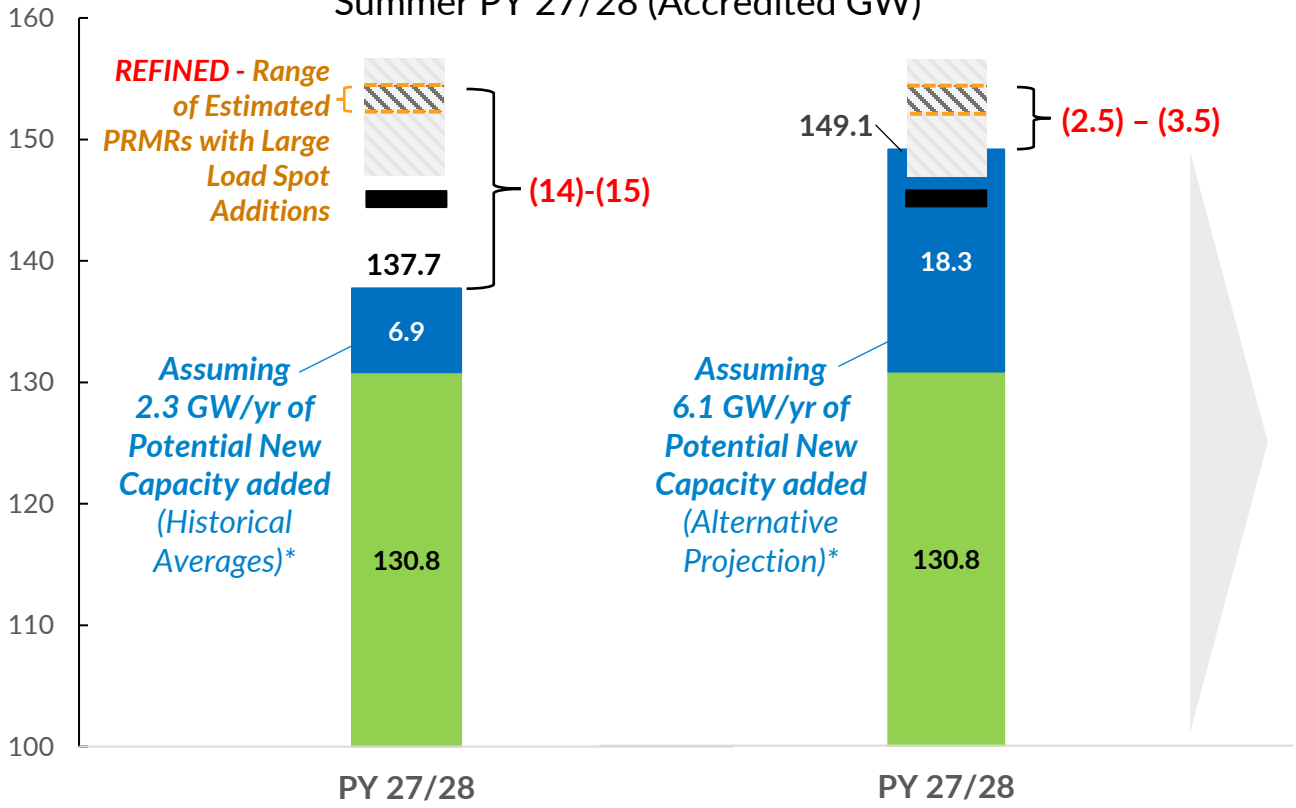


https://www.epri.com/research/products/000000003002027930 https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf

The trend of announced large load additions will exacerbate the urgency for new generation, including dispatchable, long-duration resources

MISO Resource Adequacy Projection vs. an Expanded Range of Future Large Load Spot Additions*

Summer PY 27/28 (Accredited GW)



Meeting a high spot load addition scenario would require capacity be added at a rate even greater rate than the 6.1 GWs/year assumed here

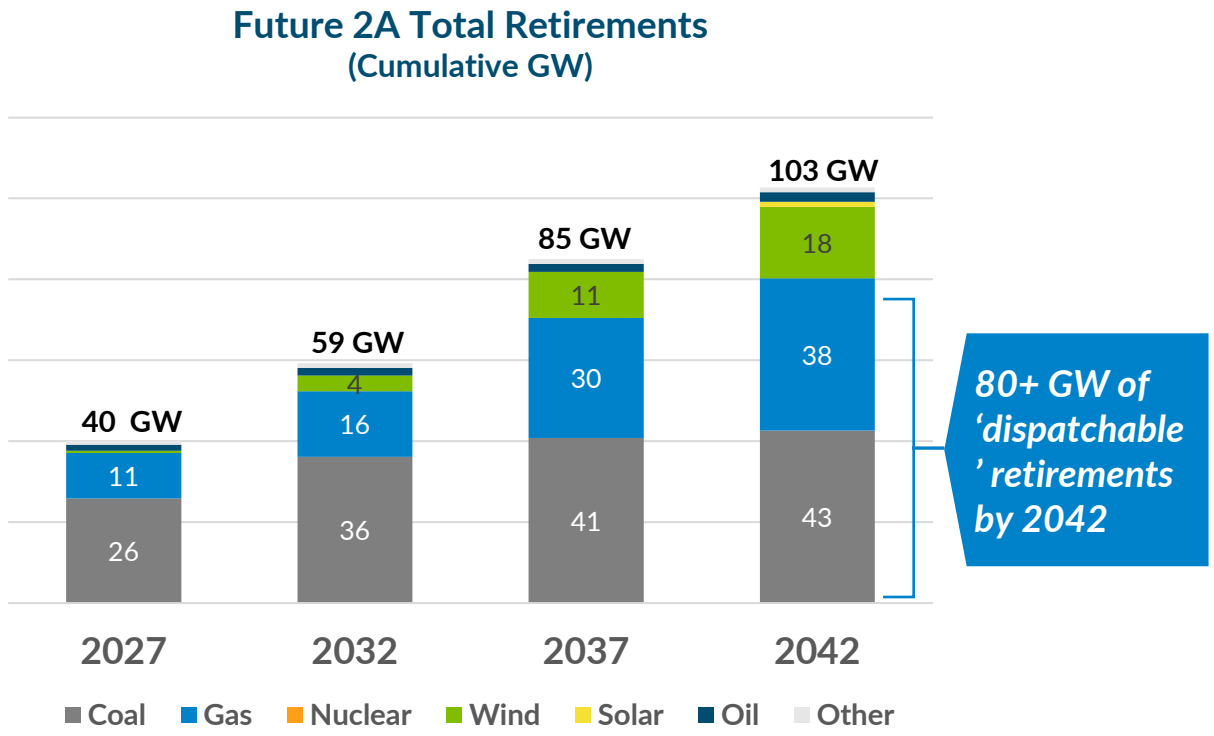
REFINED Range of Estimated PRMRs with Large Load Spot Additions
ORIGINAL Range of Estimated PRMRs with Large Load Spot Additions
Projected PRMR with LSE load forecast
Potential New Capacity
Committed Capacity

- Bracketed values indicate difference between Committed + Projected New Capacity vs. Projected PRMR with large spot-load additions
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1900 MW is reflected in this chart

** Using methods for Potential New Capacity and Large Load Spot Additions described in 2024 OMS-MISO Survey presentation*
PRMR: Planning Reserve Margin Requirement

Policy direction is accelerating thermal unit retirements and increasing the headwinds to new thermal unit development

- Member/state clean energy and decarbonization goals
- U.S. Environmental Protection Agency (EPA) regulations:
  - Carbon Rule
  - Good Neighbor Rule
- Inflation Reduction Act and Infrastructure Bill



MISO will need to assess Futures to determine if recent developments, especially related to the Carbon Rule, will limit existing resources and may cause additional retirements beyond those assumed here

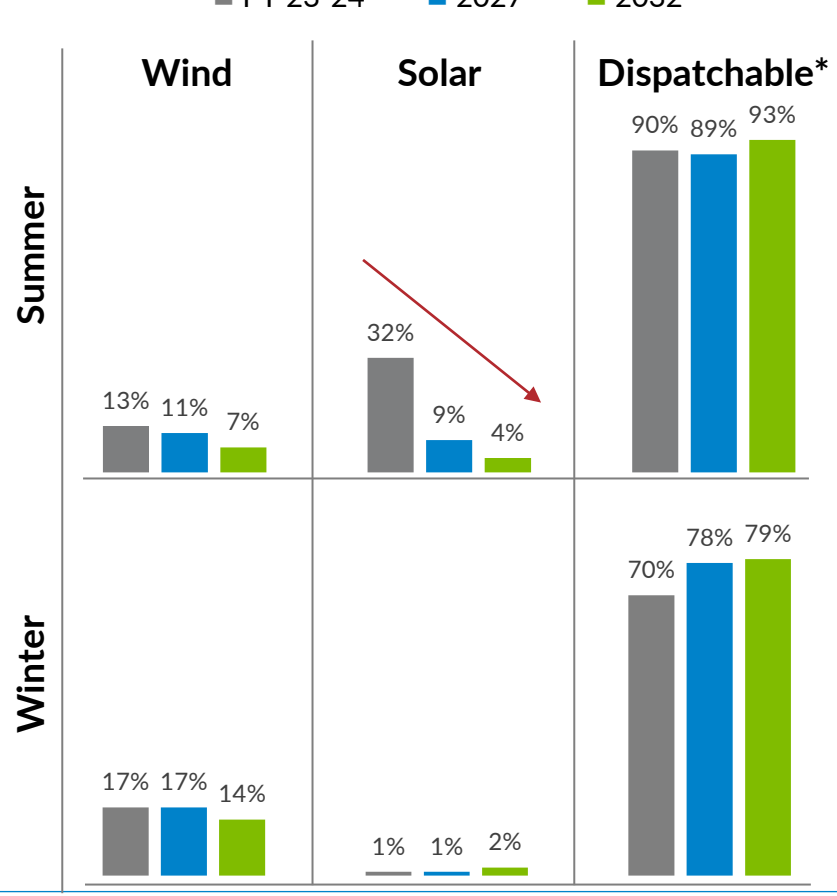
Filed accreditation changes designed to improve alignment with the reliability value of resources

Approach

- Risk hours expanding from summer peak to also include winter
- Seasonal marginal value based on 'Direct Loss of Load' (DLOL) approach matches accreditation with risk hours based on class and individual asset performance
- Solar accreditation falls off with higher levels of penetration because risk hours are shifted to early evening

Indicative Accreditation Trends

(% of installed capacity)



Expected Outcomes

Accreditation based on reliability contribution is the right direction, but it comes with additional coordination challenges as MISO Members evolve their fleets

** Includes coal, gas, nuclear, hydro, pumped storage, etc.*

MISO has made considerable progress on evolving our processes and tools to support resource adequacy, but additional coordination can drive more efficient and effective resource planning

Recently Completed / In-Process

Initiative	Objective
Seasonal Requirements in Planning Resource Auction	More accurately reflect variations in resource capabilities and availability
Accreditation Enhancements	Improve alignment of capacity "value" with reliability contribution
Reliability-Based Demand Curve	Improve price signals for capacity and inform investment decisions
Shortage Pricing	Incentivize market participant real-time behavior and actions to avoid potential shortage situations

Next Opportunity

- As the fleet continues to evolve, visibility and clarity will be critical to support timely and prudent action.
- MISO processes and assessments provide insights into the region's short- and long-term supply and demand picture:

Planning Resource Auction	1 Year
OMS-MISO Survey	5 Years
Regional Resource Assessment	20 Years
MISO Futures	20 Years

- A recent stakeholder survey uncovered a desire to evaluate streamlining MISO's assessments, which may improve participation.

With stakeholder engagement to prioritize and sequence critical work, we expect to make significant progress on other key Market Redefinition initiatives

Examples of deliverables in 2024

Reliability Attributes

Integrate solutions identified in the Attributes Roadmap related to priority risks of system adequacy, flexibility, and system stability

Deliverables

- Ensure resource adequacy and energy market signals are incenting emerging needs
- Require capabilities to strengthen the grid

Scarcity Pricing

Send the right signals about the value of energy and other products leading up to and during scarcity conditions

Deliverables

- Present proposed changes to relevant pricing curves for stakeholder feedback
- **Targeting FERC filing 2024**

Reliability Metrics

Recognize the limitations of the Loss of Load Expectation metric to determine system adequacy

Deliverables

- Evaluate new or additional risk metrics for resource adequacy assessments and their potential to improve underlying risk models

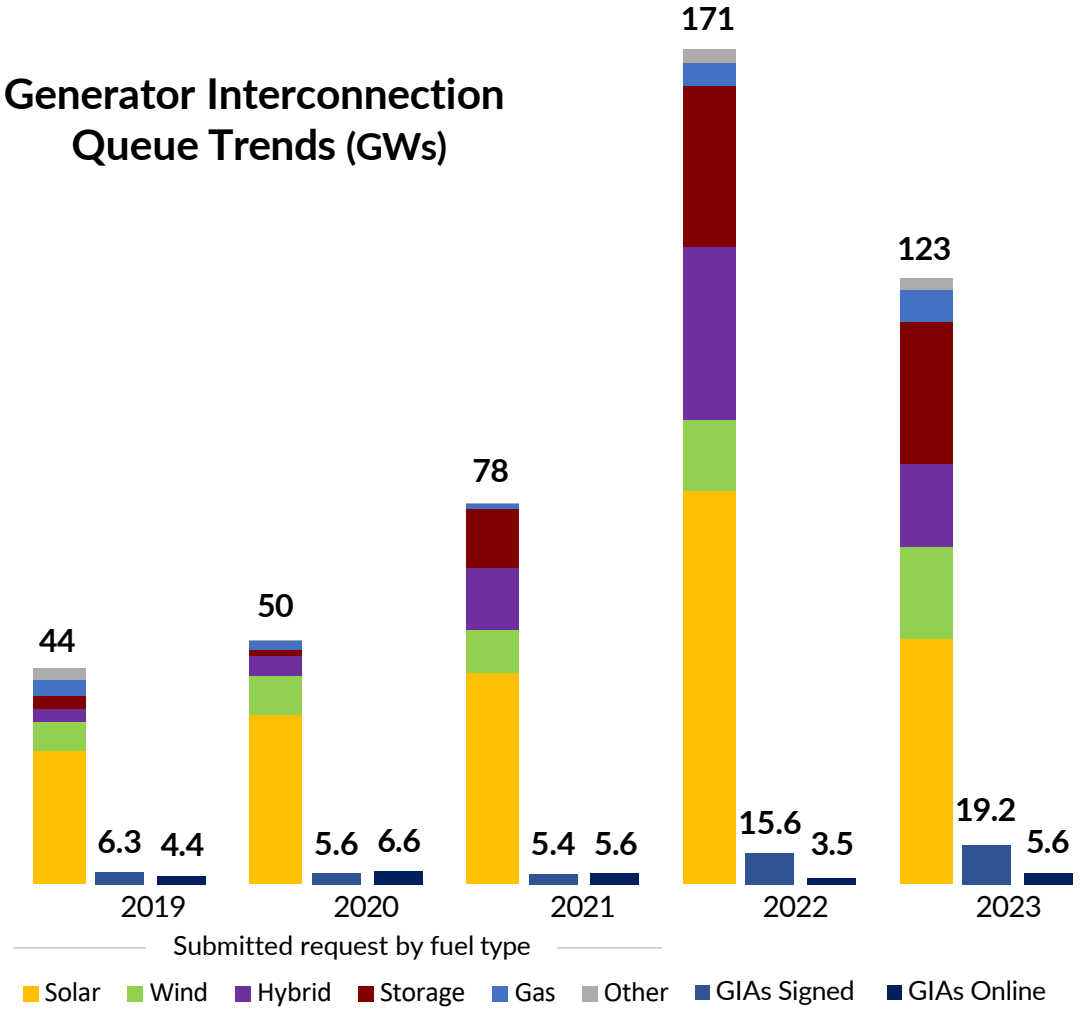
Load Modifying Resource (LMR) Accreditation

Align accreditation with availability and account for characteristics

Deliverables

- Reliability in last stage of emergencies
- Visibility in MISO Clearing Engines
- Certainty for MISO and Stakeholders
- **Targeting FERC filing 2024**

MISO reforms and Order 2023 measures to improve project readiness appear to be effective as the 2023 Queue volume decreased by 30%



Generator Interconnection Requests

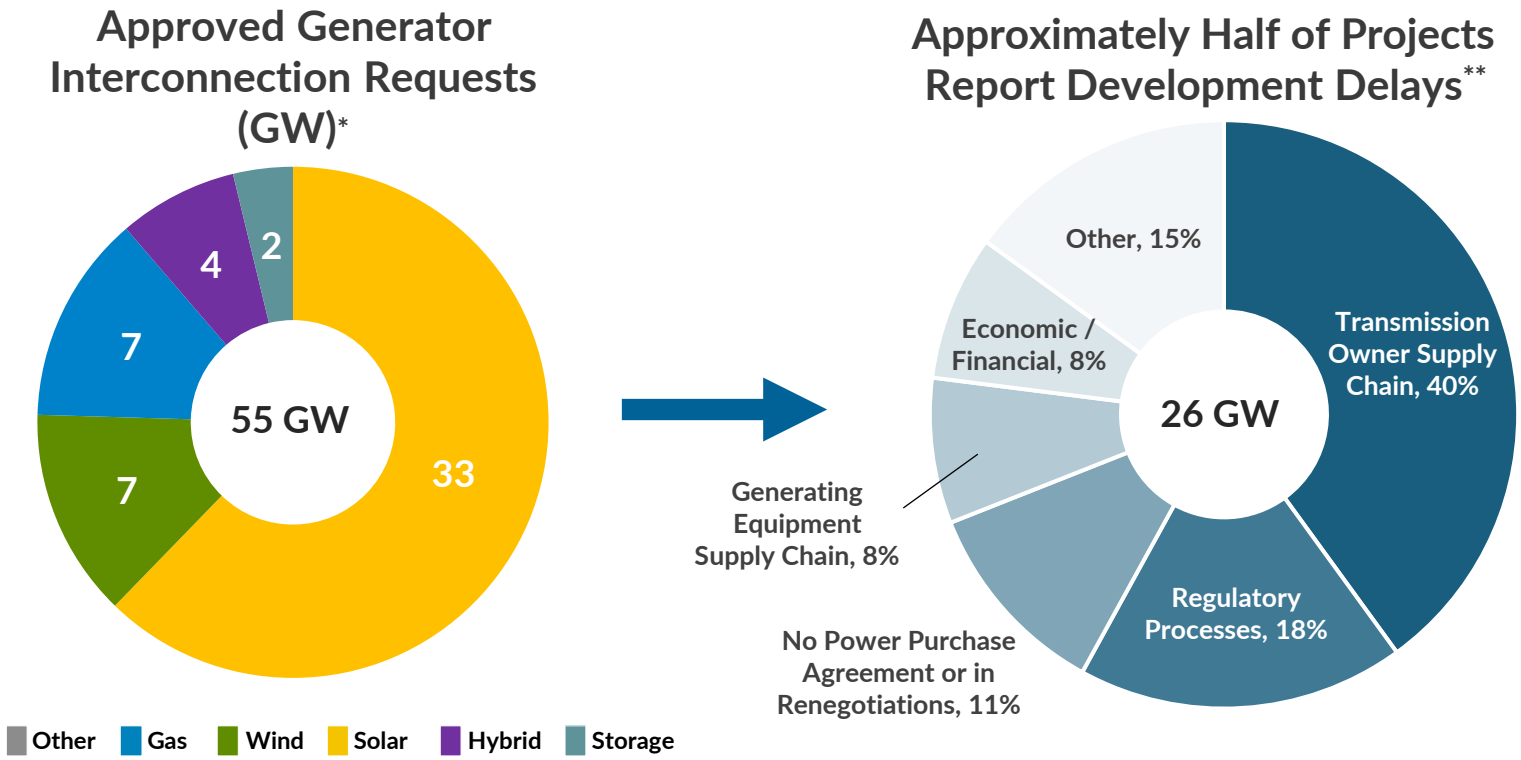
GI Requests	2023 New*	Active Queue**
Size	**123 GW**	**349 GW**
Solar	41%	49%
Storage	23%	21%
Hybrid	14%	16%
Wind	15%	11%
Gas	5%	2.5%
Other	2%	0.5%

- Reforms included withdrawal penalties and improvement to site control rules
- Signed Generator Interconnection Agreements are increasing
- Construction delays continue, with an average of ~5 GW per year of nameplate capacity coming online annually

* The 2023 Generator Interconnection Queue application cycle was deferred to April 2024

** *Active Queue* represents Generator Interconnection requests still active from prior years + *2023 New* requests as of 6/12/24

While we are approving more new resources, approximately half continue to experience delays in getting online

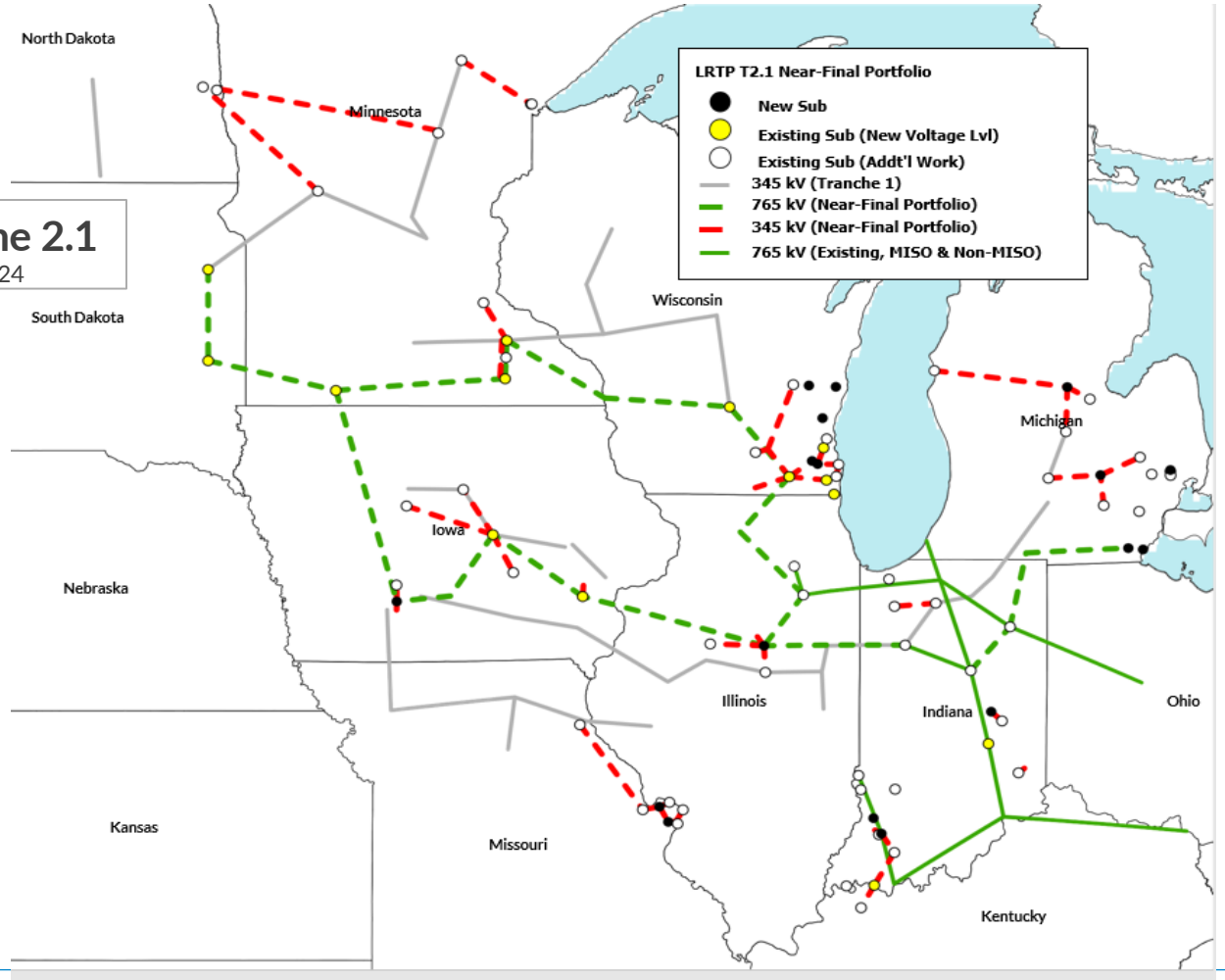


50 GW of resources approved through MISO's interconnection processes are in or awaiting construction with approximately 50% already signaling a delay

*Queue data as of September 4, 2024
** Reasons for delay based on responses from a subset of delayed projects

This work has resulted in a near-final portfolio, which will continue to be refined through business case analysis, with investment expected to be $21 billion

Near-Final Tranche 2.1
Projects as of 07/12/2024



MISO has been active on many fronts to improve the manageability of its Queue and provide a critical path to timely resource approvals

MISO Queue Cap Proposal

- Limits GW capacity in each queue cycle study
- Helps MISO and neighbors manage the study process and conduct studies more quickly
- Proposal specifics previously rejected by FERC will be revised and refiled in 2024

FERC Order 1920

- Compliance filings due 10 and 12 months after effective date
- Requires changes to local, regional, and interregional processes
- Requires engagement with states on cost allocation and selection criteria

FERC Order 2023 Compliance

Compliance filings completed in May

- Addresses queue backlogs, improves certainty and prevents undue discrimination for new technologies
- Most directives are consistent with MISO reforms filed with FERC in January 2024
- MISO adopted approximately 15 reforms

Retirements / Replacement Process

- MISO improved its resource replacement process to correlate with the Attachment Y process and will continue streamlining processes as retirements accelerate

Coordinating and executing on the priorities within the Reliability Imperative is required to address challenges to reliability

RELIABILITY CHALLENGES

- Attributes needed to ensure reliability will become more scarce
- Extreme weather events are more frequent and severe
- Large single-site load additions and incremental load growth
- Fuel-assurance issues with gas pipelines and other energy infrastructure
- Supply chain and permitting issues are delaying generation projects
- Investor preferences to/not to finance new energy projects

KEY INITIATIVES[1]

MARKET REDEFINITION	• Resource Accreditation • Reliability Attributes • Pricing Reforms • Forecast Uncertainties
OPERATIONS OF THE FUTURE	• Uncertainty & Variability • Planning & Preparedness • Situational Awareness & Critical Communications
TRANSMISSION EVOLUTION	• Long Range Transmission Planning • Generator Interconnection • Joint Transmission Planning[2]
SYSTEM ENHANCEMENTS	• Hybrid Cloud Capability • Fortify Cybersecurity • Advanced Data Analytics Capabilities

[1]*Partial listing of initiatives;*
[2]*Includes Joint Targeted Interconnection Queue (JTIQ)*

As MISO executes on Reliability Imperative priorities, broad coordination is needed to consider all actions to support reliability and load growth

- Delaying retirements / maintaining existing fleets continues to be the best immediate lever
- Consideration for relaxed renewable / clean energy goals, providing longer glidepath, to reflect the magnitude of landscape change since many of them were implemented
- Collaboration on potential options for expediting the most critical new resource additions
- Moving LRTP Tranche 1 projects forward quickly and preparations for the same on Tranche 2.1

FORWARD TOGETHER RELIABILITYFIRST

2024 FALL RELIABILITY SUMMIT

Brian Thiry, Director Entity Engagement and External Affairs

Michelle Cross, Manager External Affairs

September 18, 2024

RELIABILITY FIRST

NERC STANDARDS UPDATE

FORWARD TOGETHER RELIABILITYFIRST

LATRICE HARKNESS

Director of Engineering, NERC

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Critical Infrastructure Protection

NERC Overview and Project 2016-02 Revisions Update

Latrice Harkness, Director of Engineering
Fall Reliability and Security Summit
September 18, 2024

Holistic Approach

- Standards are one part of a holistic approach to Reliability
- Other essential NERC functions:
  - Registering and Certifying entities
  - Engineering analysis of past performance and assessments of future risks
  - System Monitoring and Event Analysis
    - NERC Alerts, Lessons Learned
  - Reliability Guidelines
  - Technical Reference Material
  - System Operator certification and training
  - Compliance Monitoring and Enforcement
  - Electricity Information Sharing and Analysis Center (E-ISAC)
  - AND MORE!

Approach to CIP

- Maintain consistent vigilance and information sharing
  - Build good-faith relationships between entities and regulatory authorities to assure a robust security posture
  - Enforcing compliance can be an effective tool but the goal is to assure a reliable, resilient, and secure electric grid
- Analyze known threat vectors, events, and reported incidents
  - Evaluate potential impacts from exposed threats (e.g., SHAMOON, Solarwinds, attack on Metcalf substation)
- Encourage proactive over reactive mindsets and behaviors

NERC CIP Standards

- Critical Infrastructure Protection Reliability Standards
  - Includes Cyber and Physical security
  - Protects information and access to Bulk Energy System assets
- Focus on:
  - Identifying applicable assets
  - Defining physical and electronic security perimeters
  - Prioritizing assets based on potential to impact the grid (High, Medium, Low)
  - Detailing roles and responsibilities
  - Remain flexible as technology and industry practices change

- Complimentary with the NIST Cybersecurity Framework

NERC CIP Standards

- CIP-002: BES Cyber System Categorization
  - Categorization of assets
- CIP-003: Security Management Controls
  - Protect against compromise
- CIP-004: Personnel & Training
  - Requires security awareness training and cyber security training programs
- CIP-005: Electronic Security Perimeter(s)
  - Define and protect an ESP
- CIP-006: Physical Security of BES Cyber Systems
  - Define methods and controls for physical security plans

NERC CIP Standards

- CIP-007: Systems Security Management
  - Specifies procedures to protect BES security systems
- CIP-008: Incident Reporting and Response Planning
  - Assures cyber security incidents are evaluated and communicated
- CIP-009: Recovery Plans for BES Cyber Systems
  - Details recovery plan specifies, implementation and testing
- CIP-010: Configuration Change Management and Vulnerability Assessments
  - Prevent and detect unauthorized changes
- CIP-011: Information Protection
  - Specify information protection requirements

NERC CIP Standards

- CIP-012: Communications between Control Centers
  - Protection of data in transit
- CIP-013: Supply Chain Risk Management
  - Create and implement a supply chain risk management plan
- CIP-014: Physical Security
  - Assure critical facilities are protected from physical attacks

2016-02 Scope

- Address the issues identified by the V5TAG as well as directives from Federal Energy Regulatory Commission (FERC) Order Nos. 822 and 843.
  - The proposed revisions in the eleven CIP Reliability Standards and associated new and revised Glossary terms enable entities to securely use virtualized technologies for BES Cyber Systems.

Virtualization Overview

- New terms – Virtual Cyber Asset (VCA) and Shared Cyber Infrastructure (SCI)
- SCI vs. “All-in”
- CIP-010 for dynamic environments
- CIP-005 and Zero Trust models
- Interactive Remote ACCESS to non-routable (serial) BCA/BCS

Virtualization Clarifications

- Electronic Security Perimeter is a security model rather than only a network topology-based perimeter, enabling entities to use a “Zero Trust” model, for example.
- Developing terms such as “Shared Cyber Infrastructure” and “Management Interface” to address risks, for example, by preventing use of “mixed trust”, where virtual machines of varying impact levels share the same central processing units, among other components, and the occurrence of “side channel” attacks where virtual systems executing on the same hardware could affect one another7.
- Applying certain CIP requirements and protections to Shared Cyber Infrastructure as an Applicable System.
- Broadening change management requirements by focusing requirements on a security objective of controlling the implementation of intended changes to software or settings that could weaken certain cyber security controls rather than only permitting a baseline configuration.

Interactive Remote Access

- As part of a V5 TAG-identified issue, the proposed revisions clarify that CIP-005 requirements will apply if: (1) a medium or high impact BES Cyber System only has non-routable connectivity (i.e., serial) but is subsequently converted to routable protocol; and (2) a remote user can still gain Interactive Remote Access to the BES Cyber System.

Key Revisions

- CIP Exceptional Circumstance
  - The Project 2016-02 drafting team reviewed which requirements were most appropriate for CIP Exceptional Circumstances, which entities may declare during certain, defined emergencies to stop complying with particular CIP standards requirements in the interest of supporting reliability.
- Incorporation of CIP-002-5.1a Interpretation
  - The proposed revisions incorporate the CIP-002-5.1a interpretation regarding “shared BES Cyber Systems” by clarifying that each “discrete” shared BES Cyber System meets medium impact rating 2.1 in Attachment 1 to CIP-002-7.
- Technical Feasibility Exception
  - The proposed revisions replace language that triggers the use of the Technical Feasibility Exception procedure in the NERC Rules of Procedure Appendix 4D with the term “per system capability” that requires entities to document limits to a system but not engage in the Appendix 4D procedure.

Reliability Benefits

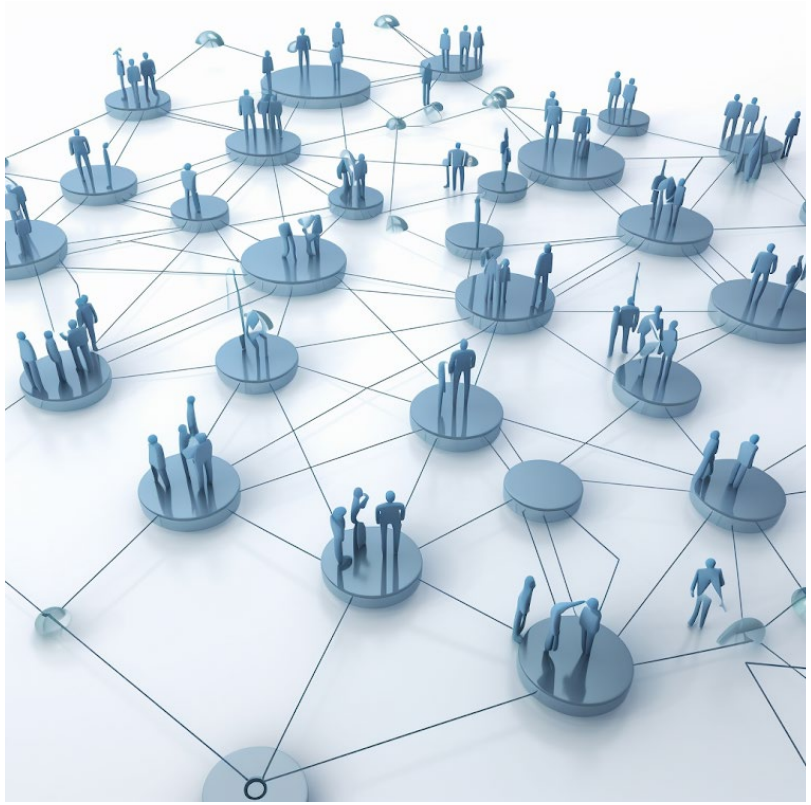
- Impart a degree of “future proofing” to the CIP Reliability Standards to respond to the fast-changing pace in technology
- Option to use “Zero Trust” security model
- Broadens change management requirements to security objectives

Standards in Development

- 2021-03 CIP-002
  - Impact rating criteria enhancements
- 2022-05 Modifications to CIP-008 Reporting Threshold
  - Reporting threshold refinement
- 2023-04 Modifications to CIP-003
  - Mitigating the risk of a coordinated attacks on low impact facilities
- 2023-06 CIP-014 Risk Assessment Refinement
  - Adjustments to physical security risk assessments

Future of NERC CIP

- Areas of focus – largest threats
  - Increasing networking and communication protocols
  - Virtualization
  - Web-based services and third-party applications
  - Distributed and increasing quantity of threat vectors (e.g., data storage, energy resources, remote access)
  - Digital supply chain



Questions and Answers

THE SANDBOX OF RELIABILITY, RISK AND COMPLIANCE

JASON THORNTON

Principal Technical Auditor, RF
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RELIABILITY FIRST

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THE SANDBOX

RELIABILITY, RISK, AND COMPLIANCE

Jason Thornton, Principal Technical Auditor, Operations & Planning Compliance Monitoring, RF

2024 Fall Reliability & Security Summit

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AGENDA

- LOOKING BACK
- KEY MOMENTS OF CHANGE
- THE SANDBOX CONCEPT
- RELIABILITY, RISK, AND COMPLIANCE
- FLORIDA EVENT
- CLOSING REMARKS

THE LAST 30 YEARS

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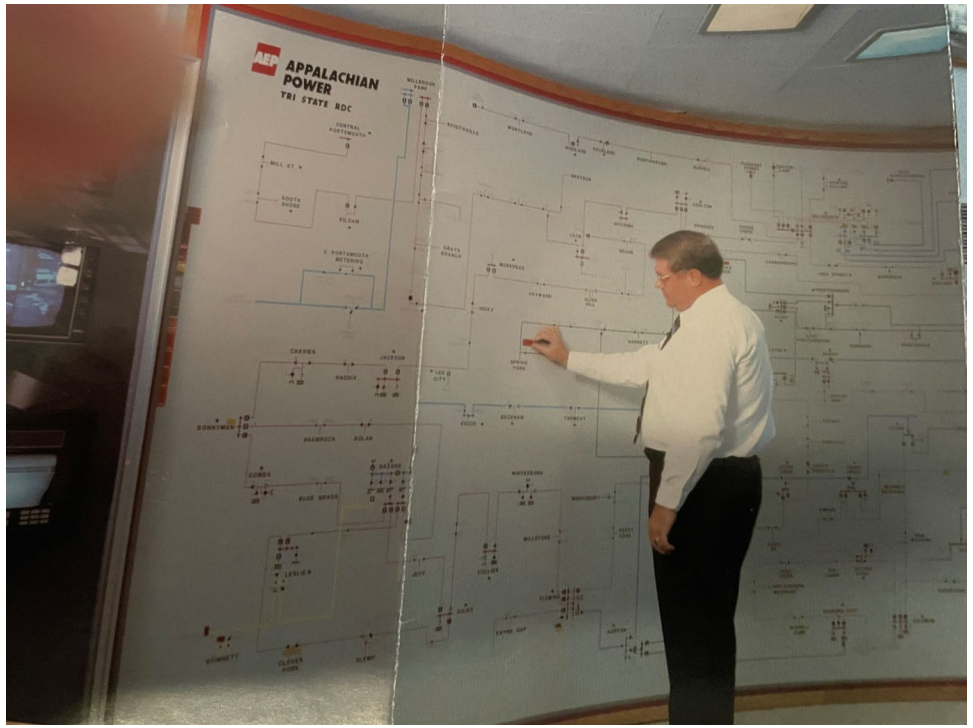
- Energy Policy Act of 1992
- Deregulation
- Competition
- Energy Crisis
- ENRON
- FERC Order 888
- No Conduit Rules
- FERC Order 679
- OASIS
- FERC Order 1000
- Required NERC Certification
- Enforceable NERC Standards
- Energy Policy Act of 2005
- Major Storm Events
- FERC Order 2000 RTOs/ISOs
- Separation of Business Units
- Regional Entities
- SCADA
- Communication Advances
- 2003 Blackout
- IPPs – Peaker Plants
- IBR (Wind/Solar)
- Transmission Growth
- Capital Investment Incentives
- EPA Requirements
- Transmission Service
- Electromechanical Relays
- Cold Weather Events

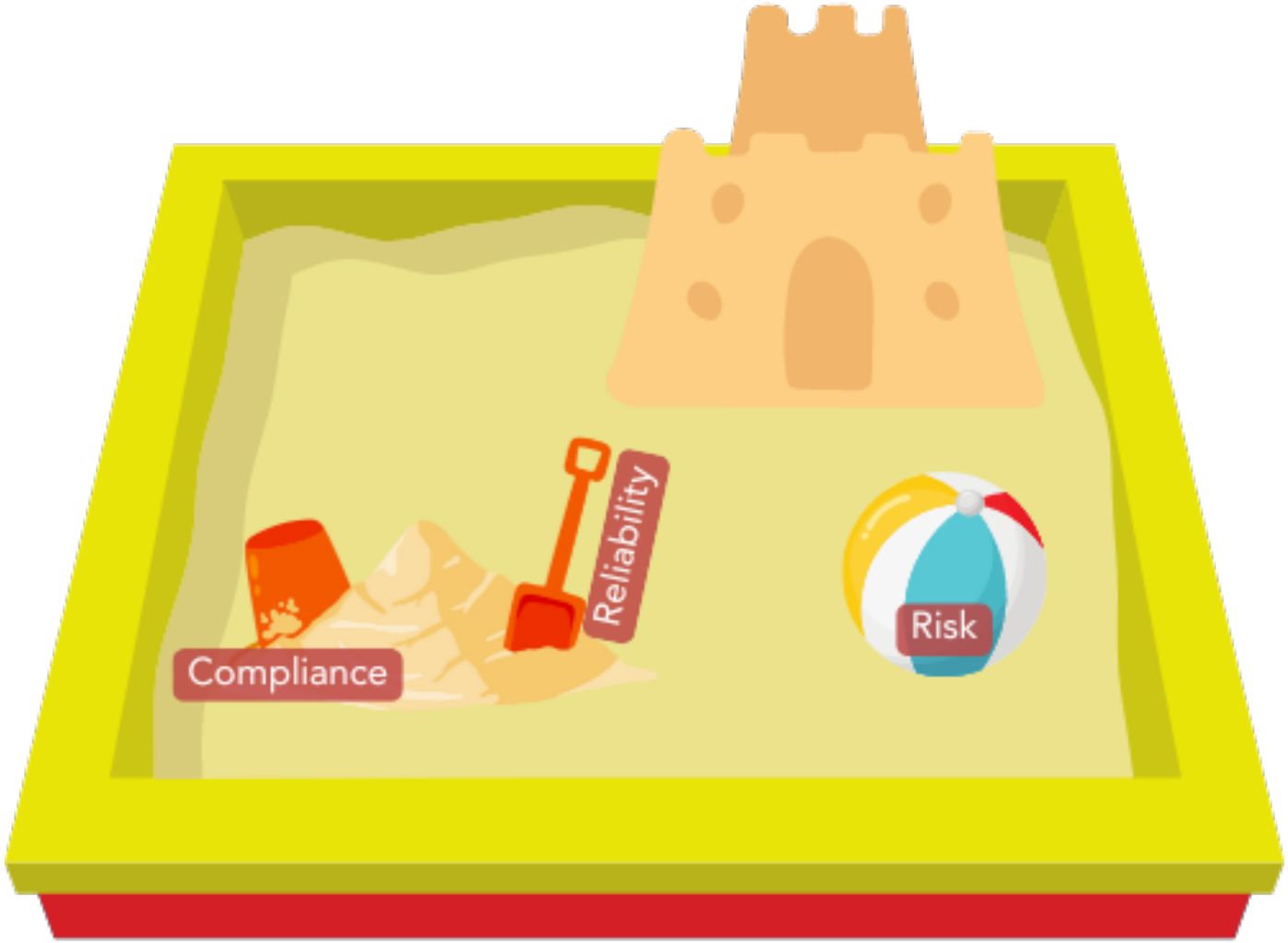
SYSTEM OPERATOR – KEY MOMENTS

- Competition/separation of generation and transmission - 1992
- Everybody wanted to be like ENRON, until 2001
- Creation of RTOs/ISOs – 2000s
- NERC Operator Certification Requirement - 2002
- Aug. 14, 2003 – Swan Dive Day
- Regional Entities created (Energy Policy Act) – 2005
- Enforceable NERC Reliability Standards – 2007
- Coal plant retirements begin – 2010s
- FERC Order 1000 - 2011



1994 AEP Tri State RDC Brochure

THE SANDBOX



RISK – RELIABILITY - COMPLIANCE

HOW DO THEY PLAY TOGETHER

Which statement(s) seem(s) correct?

- Without compliance, risk increases and reliability decreases.
- If risk didn't exist, there would be no compliance.
- Reliability is removing risk.
- Compliance reduces risk and increases reliability.
- Reliability principles are the basis for the NERC Reliability Standards.

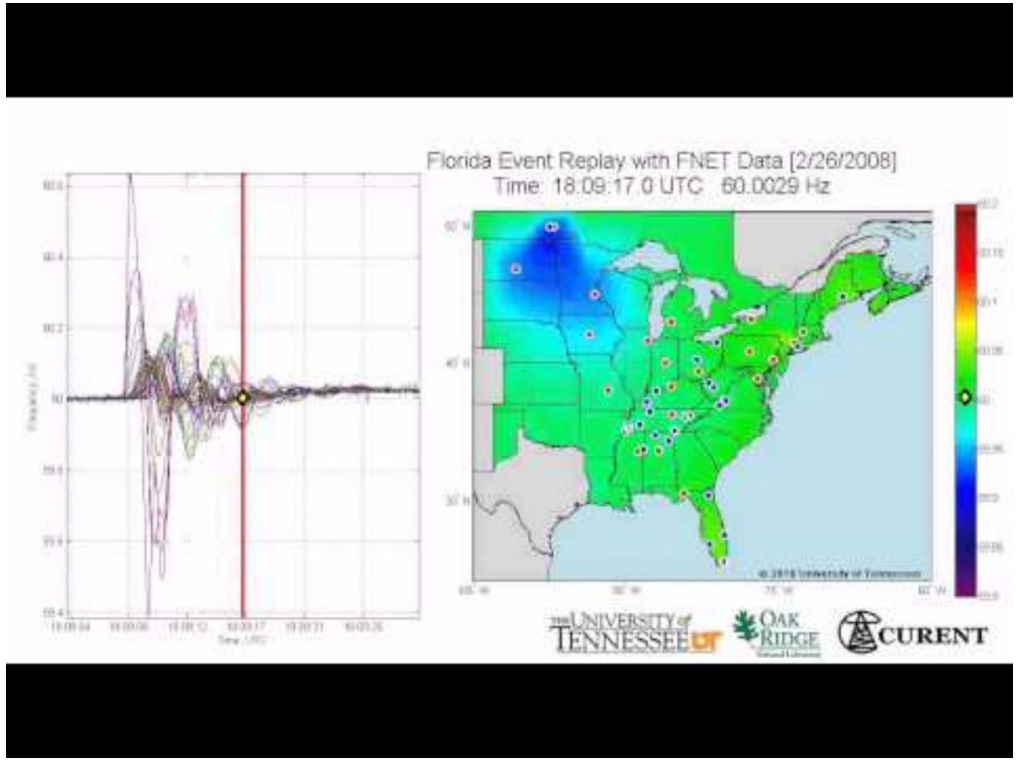
THINK ABOUT IT

What changed or is changing in compliance due to these events?

- Aug. 14, 2003 Northeast Blackout – (training, awareness, vegetation)
- Florida Blackout 2008 – (inadequate protection measures, assessments, communication)
- Cold weather events (preparedness, planning, definitions of cold weather)
- Generation retirements
- Inverter-based resources

FLORIDA EVENT (DEEPER DIVE)

- Protection Systems Disabled (Primary and Backup)
  - 22 Transmission Lines
  - 4300 MW of Generation
  - 3500 MW of Customer Load
- NERC Standards
  - BAL, COM, EOP, PER, PRC, TOP, and TPL
- $25M Settlement
  - Additional $350,000 for RC Function (IRO and COM)



https://youtu.be/bdBB4byrZ6U?si=MDhBzSWCLV-xg0Kc

RESULT OF RULING

- Ruling resulted in greater industry awareness around the risk of reduced and inadequate protection for relay systems.
- Regardless of the violation language, that did not identify a specific requirement(s), entities were taking actions to avoid the risk. A reliability precedence was established even though protection systems were not specifically addressed in this capacity in the Reliability Standards.
  - Would actions be taken by other utilities if the entity was not found at fault?
  - Did the $25M settlement help drive attention to this matter?

CHANGES TO NERC STANDARDS

As a result of the Florida Blackout in 2008, the following standards and requirements were created or modified:

- .

WHAT DID WE LEARN

Risk

- Risk is not necessarily always known, so there is never zero risk.
- However, risk can be managed and controlled if you follow the guidance provided to minimize risk.

Reliability

- Reliability is an expected state that we manage through good policies, continuous improvement, evaluation of risk, and ultimately adherence to what are known as best practices.

Compliance

- Compliance does not cover every risk and is meant as sound guidance for reliability.
- A proactive approach to compliance is needed to reduce risk and improve reliability.

COMPLIANCE – RISK - RELIABILITY

WHAT DOES IT REALLY LOOK LIKE

HOW DO WE MANAGE RISK

CONTROLS

CULTURE

RISK

What risks do we face? What keeps you up at night?

Overall Risks

- Event Response & Resilience
- Situational Awareness
- Planning & Modeling
- Cyber and Physical Security
- Protection System Misoperations
- Human Performance
- Vegetation Management
- Extreme Weather

CIP ERO Identified Risk Themes

- Latent vulnerabilities
- Insufficient commitment to low impact CIP programs
- Shortages of labor and skillsets
- Performance drift

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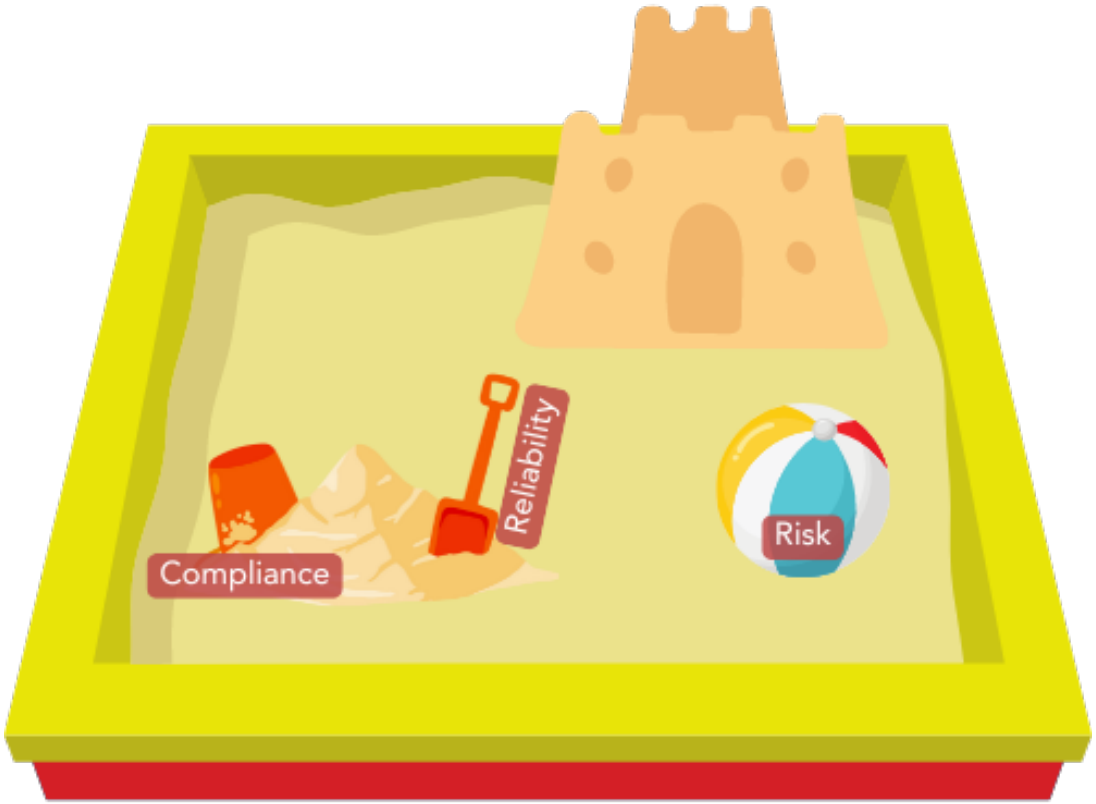
#RFSummit24

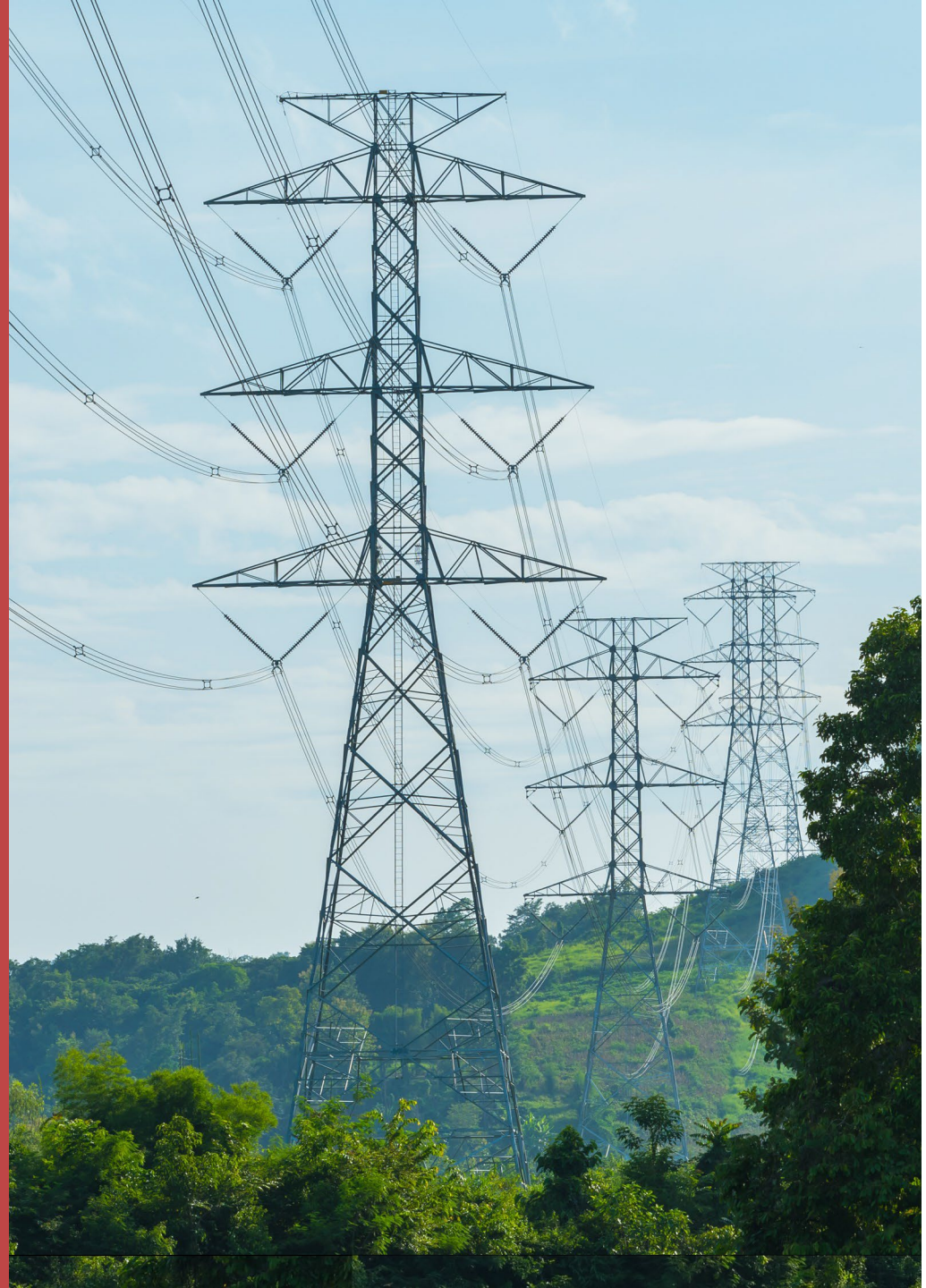
RELIABILITY

- Understanding risk before it becomes a risk and setting up controls to manage those risks.
- Operating within the boundaries established by the Reliability Standards.
- Being proactive and sharing ideas and concerns.
- Setting a tone that supports all activities that contribute to reliability.
- Being a partner to those in front, behind, up, down, and sideways while making sure your actions are supportive.
- Being active!! Take advantage of resources, join teams and committees, and make a difference. We need you!

COMPLIANCE

Something you want to do or something you have to do?





FORWARD TOGETHER RELIABILITYFIRST

QUESTIONS & ANSWERS

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